The Transportation Crisis*

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I

The conditions which surround the distribution of the world's products today have eached a crisis in the United States, and the problem for relief calls for enormous ıms of money as well as a modification of the existing policy. As the question con-erns the welfare of every man, woman and child on the globe, since it affects their ıpply of food, clothing, shelter and revenues, it is of paramount importance, and yet s an economic proposition it appears to have been sadly neglected by those most inter-sted, namely, the people.

Not so, however, with the Captains of Industry, who have secured general powers om Governments which have enabled them to control and sell transportation under ıe rights of eminent domain and to charge what the traffic would bear, so that stren-ous efforts are making to check the enormous power which has been concentrated in w hands by restrictive legislation.

But anyone at all familiar with the operation of railways will understand the futility thus attempting to regulate the charges upon the various lines in a country having many diverse physical conditions to contend with. What would prove beneficial to ıe would be ruin to another, and it is a practical impossibility to formulate rates to ver the ever-varying conditions of the traffic.

The best, if not the only, panacea for the regulation and relief of the people from orbitant charges and delays, discriminations, rebates, terminal charges, watered capi-l and other forms of extravagance is by application of the natural law in the physical orld, which may be secured by general legislation, enabling the natural highways of mmerce to be developed and used by whoever may be in position to do so. This herent right has been so usurped by those whose interests it is to control the avenues traffic that it has led to the formation of transportation oligarchies, which have not ly monopolized the business of large communities, but have also dominated legislation such an extent as to compel many large plants to pay such enormous tribute as to rce them out of business or drive them to seek more favorable conditions elsewhere.

Although some $16,219,573,845 were invested in railroads under corporate manage-ent in 1905, the people, as such, had practically no control of the properties, and even e boards of directors were never sure of their holdings so long as their securities were the market subject to purchase by some covetous rival. The process of eliminations d concentration has been going on so rapidly of late that normal competition has nost ceased to exist.

So long as the track or way is owned or controlled by any corporate body, just so ng is it impossible for the public to enjoy its use as a free and open avenue of mmerce.

It is an indispensable condition of *railways* that they shall be owned and operated some sytematic management, under schedule, to regulate the movements of traffic, d in this respect it differs materially from the highway or waterway, which may be

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improved at public or local expense and be available to all persons having a vehicle or vessel capable of passing over it, at their own convenience, or for a reasonable charge for maintenance of the way when under corporate control. The physical properties of water make it an ideal medium for the cheap interchange of commodities, especially in bulk, so that it has ever been a dominant factor in the growth of the world powers, and yet the present condition of the waterways of these United States would indicate that its potency has not been appreciated by the people. We are expending enormous sums for destructive agencies and naval vessels before we have the waterways in which they may be navigated. More than 70 per cent. of the total appropriations of the country are for war and its sequences, while the small balance only is available for the arts of peace and internal development, with all the expenses for administration of the constructive elements of the nation. Is this judicious?

A Policy of Extermination.

Since these great physical advantages rendered it difficult, if not impossible, for the railways to compete with them, it became the policy in some countries to purchase and exterminate the canals and slackwater improvements, so that the traffic could be diverted to the railway, requiring a higher rate for its movement, and although it is very justly claimed that the average rate in the United States is less than that in any other part of the world for rail traffic, it is not because of the competition from improved waterways, but in consequence of the absence of them, and is a direct loss to the railways as well as to the public. This has led to the admission from the Secretary of Internal Affairs of the great State of Pennsylvania that "*the average receipts per ton mile upon all the railroads are very much lower than they were when the canals were in operation.*"

One would naturally infer, therefore, that if the railroads wished to increase their revenues they would restore the canals, but this statement was intended to show that canals were obsolete, as some 800 miles had been purchased and abandoned by the railroads, while others have been leased for a long term of years and the traffic transferred.

These few facts will serve to illustrate the distorted condition of the transportation question in this country and the necessity of a radical change of policy. It will be apparent that the relief must come from a more general use of the incomparable system of watercourses with which the country is so highly favored, and it will also suggest a mode of rendering them available without serious drain upon the National Treasury for their early utilization.

In this analysis much may be learned from the experience of the past in the evolution of our various systems of internal transport, so that a brief retrospect will be submitted as a guide to the best course to be pursued in future. In the colonial days the competition between the States was so great as to utterly demoralize commercial intercourse. This condition of affairs caused Massachusetts to call a Continental Congress to meet in Philadelphia in 1774 for the better protection of the trade of the Colonies. Out of this grew the Declaration of Independence and the Revolution of 1776, which was followed by still greater depredations due to the enfeebled condition of the States which were jealously contending for their independent sovereignties and which made it necessary to vest control and regulation in the General Government. This resulted in the final adoption of the Constitution of the United States on the 17th day of September, 1787, when it was determined that *inter alia* Congress should have power "to regulate commerce with foreign nations and among the several States and with the Indian tribes * * * and to establish postoffices and post roads."

Under these simple and general provisions it was the policy of the Government to authorize the States to collect duties or to apply a percentage of their revenues from the sale of public lands to the improvement of their ports or channels, or to build breakwaters and remove wrecks or other obstacles. Many of the States granted charters to corporations to construct public improvements within or even beyond their borders by joint action, and under this system some 5000 miles of canals were built at a cost of about $150,000,000 prior to the Civil War. This money was secured by sale of the securities of the corporations, and in a few instances by lotteries. During this time the National Government had appropriated less than $15,000,000 for similar improvements, which were under the supervision of "proper and intelligent persons," Collectors of ports, the Secretary of the Navy, or of the Treasury, or the President, the Quartermaster-General or the Secretary of War.

National Regulation.

The general policy of regulation by the National Government is said to have been established by the great War Secretary, Edwin M. Stanton of Steubenville, Ohio, who was the counsel for the State of Pennsylvania in its suit to restrain the Wheeling & Belmont Bridge Co. from erecting the wire bridge over the Ohio at Wheeling in 1847, and thus obstructing the passage of steamers on the river. Stanton boarded the steamer "*Hibernia*," whose smokestacks towered 80 feet in the air, and ran into the bridge, which carried them away with the upper deck and caused the Supreme Court to order the bridge removed or raised to an elevation of 111 feet above low water before February 1853. In the meantime a bill was passed by Congress declaring this bridge to be a part of the national road and of lawful height, so that it remained until razed by a storm a few years later. This decision merely established the authority of Congress to protect the waterways from encroachments by the placing of obstructions over or upon navigable channels, and yet numerous instances may be cited today where permanent bridges have been erected over important streams to the injury of the existing commerce, and the jurisdiction of the Government has been extended so far as to prohibit the States from making improvements of riparian interests without first securing the consent of Congress, and has denied the usufruct necessary to give such projects the necessary commercial basis to justify the work by State or corporate control, and yet the demands for appropriations from the National Treasury for works of this class are so enormous and persistent from all parts of the country that it is impossible to secure relief from this source for many years, if not for generations. In fact, the inlets and smaller streams, which form so important a part of the internal system of interstate commerce, are in many cases barred by the reports that they are "not worthy of improvement" by the Government, because of the absence of sufficient commerce to justify the expense, while there is no commerce because of the very obstacles which it is desired should be removed, but which cannot be done so long as the Government retains control.

So great has the demand for public appropriations become that in his recent remarks upon the policy to be pursued the able chairman of the rivers and harbors committee has stated that "the impression had gained acceptance that a large part of the amounts appropriated was expended upon insignificant streams. An examination showed that in 1902, out of $65,000,000, only $300,000 or $400,000 was apportioned to rivers and creeks of minor importance, while in the bill just passed, amounting to $87,000,000, the total amount so applied was less than $1,000,000." It thus appears that these minor channels are unable to secure their reasonable allotment, and since localities may not improve them without Government consent and control, which it requires years to secure, these important feeders are not developed and the traffic is forced to pay rail

rates, while the water is at the doors of the shippers, but not available because of slight local obstructions in the route. Delegations have repeatedly appeared before the committees of Congress and importuned them for permission to make their own improvements at their own cost, stating that for years they have awaited relief from the Government plans, which have merely increased the difficulties, and called for large appropriations for the removal of obstacles thus created, but without avail. Yet in a few instances special legislation has been granted lately to corporations to improve sections of navigable streams at their own cost and risk and to charge tolls upon the traffic thus created for a period of 40 years, thus encouraging the private development of localities to the great relief of the Treasury. The policy is one which has worked to great advantage in the past, and which has also given to this country the incomparable system of railroads which is now engorged by the enormous productivity of the nation.

On this point Prof. F. H. Dixon, in an address before the Railway Club, said: "By all means let us have our waterways developed when such development is economically justifiable. * * * Such projects should be carried out by the localities interested and the burden should be borne by those who are deriving the benefit. Only in large undertakings of national concern should the General Government be called upon for aid."

This is the condition which is being forced upon Congress, with about $500,000,000 worth of work awaiting appropriations to meet present demands, and yet while the legislation is limited to these general and imperative projects no relief is provided for the very large amount of tonnage which originates in the lesser tributaries and is held by the overland carrier.

The chairman further states that it has been the aim of his committee "to recommend appropriations with the utmost care that all localities may receive just and equal treatment, and to consider that many important improvements have been receiving appropriations for over 20 years, without sufficient money to make any part available. These, with others contemplated, would aggregate in cost more than $400,000,000, so that among the rules which have been adopted it is provided that appropriations should be made in the first instance for harbors and channels where large commerce already exists and the increasing size of boats and demands of traffic require additional facilities. Another principle intended to be observed is that a selection should be made, and that pending improvements of the greatest merit should be first completed, and this even when those not selected are of equal merit." It would appear, therefore, that the action recommended by the National Board of Trade as early as 1896 was wise, and should have been adopted, that the present congestion might have been in part alleviated. It was then—

"*Resolved*, That the policy hitherto existing of granting rights and franchises to private corporations for the purpose of improving tributary channels as feeders, and thus developing the resources and industries connected therewith, involving also the power to collect tolls thereon for a limited period, is judicious and should be encouraged as the most expeditious and economical method of improving lateral or connecting waterways."

But between patronage and vested rights this resolution has never been acted up in full by Congress. It has merely gone so far as to grant the rights to States, corporations or individuals on condition that no tolls should be collected and that the plan and control should remain in the hands of the General Government, which made the relief desired impracticable.

The utter impossibility on the part of the railroads to safely and expeditiously conduct the transportation of the country as it exists today will be shown more fully in the relative increments of population, mileage, traffic facilities and financial resources in a subsequent paper.

II

The first permanent settlement of the English was made under the reign of James I at Jamestown in April, 1607. Under their charter the colonists were permitted to export free of duty whatever was necessary from England for a period of seven years, and to engage in free trade with foreign nations, as well as to levy a duty on imports for the benefit of the colony. The extent of any settlement was limited to 50 miles each way along the coast and 100 miles inland, making an area of 10,000 square miles, so that the settlements were not within easy supporting distance and were only accessible by water.

Under these provincial governments and the aggressions of foreign powers, augmented by the animosities of the native tribes, the growth of the colonies was very precarious, and little could be done to improve the lines of communication save by such local efforts as were within the resources of the more densely-settled communities.

Thus as the population expanded along the lines of least resistance and greatest resources the avenues of communication were opened up by the localities interested in the traffic without awaiting the passage of laws from the general government and the collection of revenues, and their subsequent distribution for such local constructions, in all parts of the Union. Had this policy been enforced the development of the resources of the country would have been seriously delayed.

The result, however, has been remarkable in the opening up of the common roads and waterways of the nation prior to the Civil War, and the unparalleled development of the railroad system of today, with its enormous tonnage. But this tonnage has reached such magnitude as to have surpassed the capacity of the railways, and calls for still further improvements in the means of transportation.

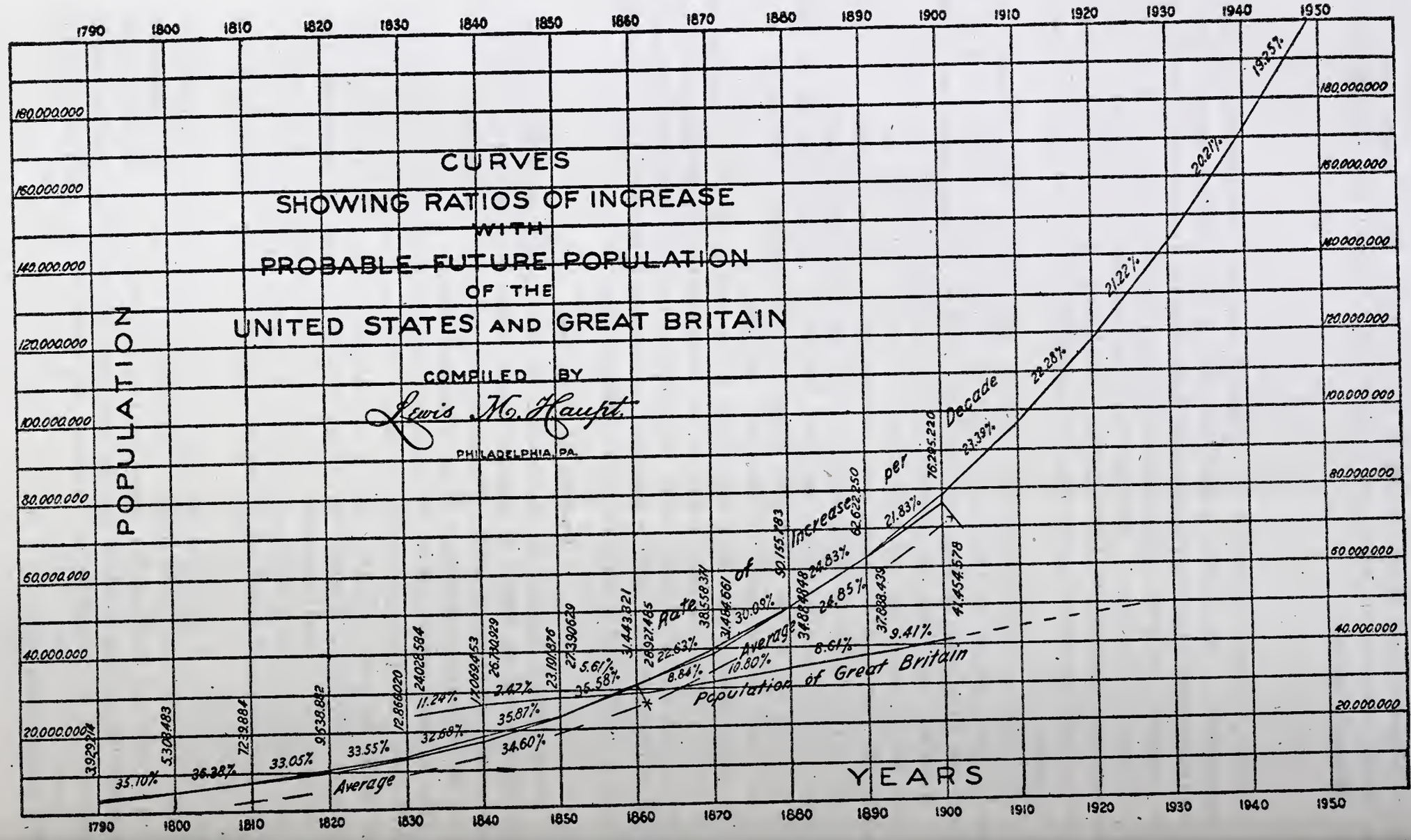
Curves of Progress.

It would appear that too much attention has been given by traffic managers to soliciting trade and to details of administration, rather than to making timely provision for the normal growth of the tonnage which results from the increase in population and the industrial possibilities of an enlightened people.

If the railroads cannot handle the tonnage of the present, what is to become of that of the future, when the population is increasing at so rapid a ratio? It is not appreciated that by the year 1935 the enumeration of the last census will have doubled, while the tonnage produced by 150,000,000 people, requiring a longer average haul to reach the seaboard, will be vastly increased. There is no other possible relief in sight than the rapid opening of the waterways wherever and however possible, and yet the Government is lethargic and unwilling to open the door for the general development of these avenues of trade.

An examination of the population curve* will convince the most skeptical of the imperative necessity for immediate action in this direction. A casual examination of the last Rivers and Harbors Act, approximating $90,000,000, just passed, will serve to show how little actual relief the domestic commerce of the country receives from this, the largest bill ever enacted for the purpose. The report of the committee states that

*See accompanying cut.


CURVES
SHOWING RATIOS OF INCREASE
WITH
PROBABLE FUTURE POPULATION
OF THE
UNITED STATES AND GREAT BRITAIN
COMPILED BY
Lewis M. Haupt.
PHILADELPHIA, PA.
POPULATION
YEARS
1790 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950
180,000,000
150,000,000
140,000,000
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
3,929,214
5,308,483
7,239,881
9,638,842
12,866,020
24,028,584
17,069,453
26,780,039
23,191,876
27,390,629
31,443,321
28,927,185
38,558,371
31,484,661
50,155,783
62,622,250
76,295,220
92,228,496
106,021,537
122,775,046
132,164,569
Rate of Increase per Decade
Average Rate of Increase per Decade
Population of Great Britain
35.10%
36.38%
33.05%
33.55%
32.68%
35.87%
34.60%
11.24%
2.42%
23.91%
5.61%
36.58%
22.63%
8.84%
30.09%
10.80%
34.82%
24.83%
21.83%
26.85%
37.88%
9.41%
41,454,578
8.61%
21.39%
22.28%
21.22%
20.21%
19.25%

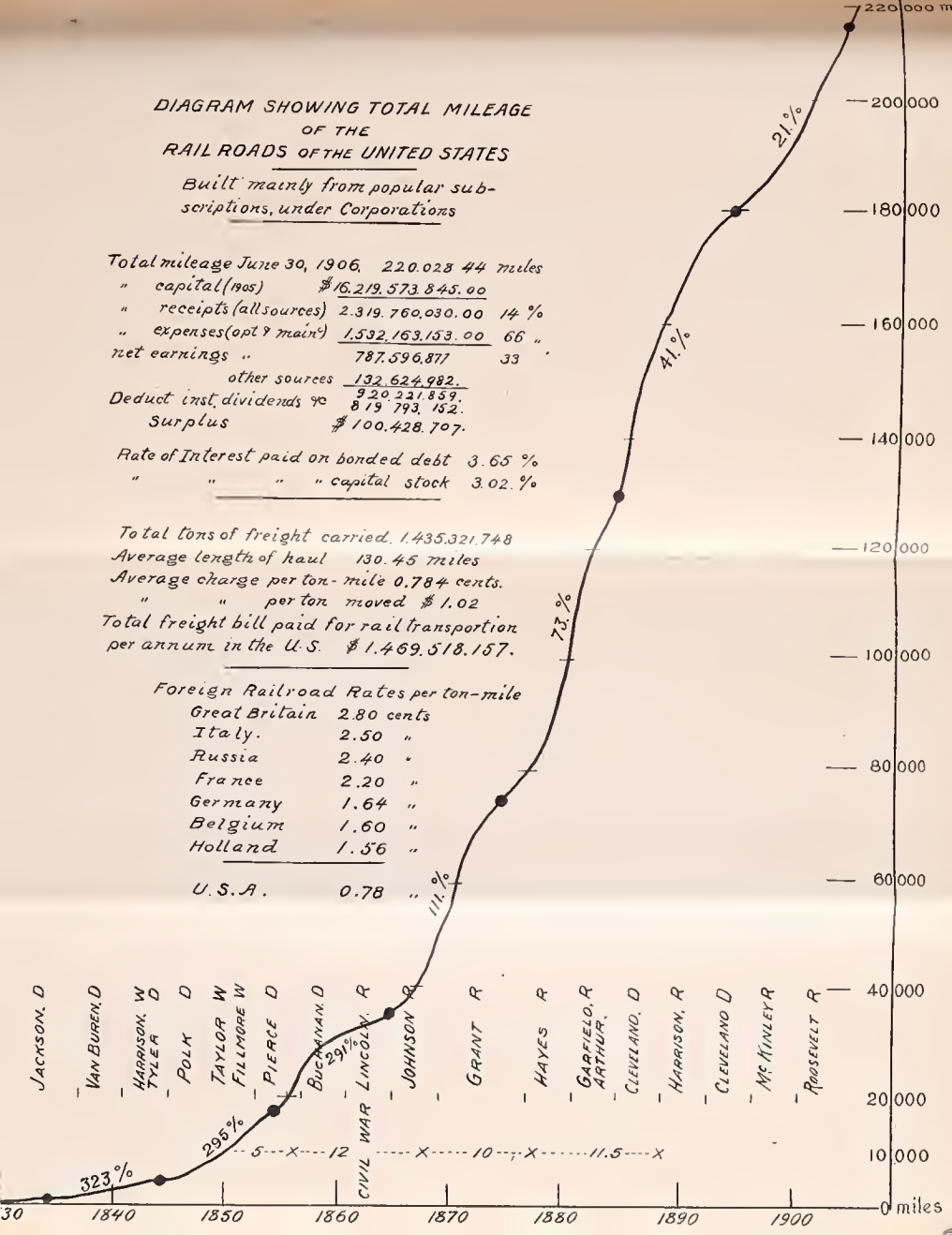


DIAGRAM SHOWING TOTAL MILEAGE
OF THE
RAIL ROADS OF THE UNITED STATES
Built mainly from popular subscriptions, under Corporations
Total mileage June 30, 1906. 220.028 44 miles
" capital (1905) $16.219.573.845.00
" receipts (all sources) 2.319.760.030.00 14 %
" expenses (opt & maint) 1.532.163.153.00 66 "
net earnings " 787.596.877 33
other sources 132.624.982.
Deduct inst. dividends &c 920.221.859.
819 793. 152.
Surplus $100.428.707.
Rate of Interest paid on bonded debt 3.65 %
" " " " capital stock 3.02. %
Total tons of freight carried. 1.435.321.748
Average length of haul 130.45 miles
Average charge per ton-mile 0.784 cents.
" " per ton moved $1.02
Total freight bill paid for rail transportion per annum in the U.S. $1.469.518.157.
Foreign Railroad Rates per ton-mile
Great Britain 2.80 cents
Italy. 2.50 "
Russia 2.40 "
France 2.20 "
Germany 1.64 "
Belgium 1.60 "
Holland 1.56 "
U.S.A. 0.78 "
220 000 m
200 000
180 000
160 000
140 000
120 000
100 000
80 000
60 000
40 000
20 000
10 000
0 miles
21.%
41.%
73.%
111.%
291%
295%
323%
5 X 12
X 10 X 11.5 X
JACKSON. D
VAN BUREN. D
HARRISON. W
TYLER D
POLK D
TAYLOR W
FILLMORE W
PIERCE D
BUCHANAN. D
CIVIL WAR
LINCOLN R
JOHNSON
GRANT R
HAYES R
GARFIELD. R
ARTHUR.
CLEVELAND. D
HARRISON. R
CLEVELAND D
Mc KINLEY R
ROOSEVELT R
30
1840
1850
1860
1870
1880
1890
1900

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51,444,674 are to be applied to projects and works requiring more than $1,000,000. f these amounts, over $20,000,000 are for seaboard terminals, where transfers are ade, so that they cannot aid in the carrying capacity of the railways by the segrega- on of the freights, but rather augment the accumulations at the principal ports by e increased demand for the larger cargoes of vessels to be laden without delay.

More than $12,000,000 are for the improvement of the Mississippi river, of which it stated that the most conspicuous feature of the entire Southern country, as observed the president of a Western university, was "not so much the enormous productivity that section as the total absence of any commerce on the river."

The condition of that great artery of trade is shown by the annual report of the ississippi River Commission for 1903, in which it is said that "systematic work, hich has for its object to permanently locate and deepen the channel, has not been acticable under existing conditions. In the limited extension and repair of bank pro- ction and contraction work the commission has, however, kept in mind that the per- nent improvement of the river is contemplated by the organic act, and experiments e continually being made looking to the best use of available material and the develop- nt of appliances and methods which may be economically and effectively employed en Congress shall provide for such systematic improvement."

The organic act referred to was passed June 28, 1879, and it directed the *commis- n* "to report in full upon the practicability, feasibility and probable cost of the vari- s plans known as the jetty system, the levee system and the outlet system, as well as on such other as they may deem necessary." And thus it appears that after the se of a quarter of a century and the expenditure of probably more than $50,000,000 commission is waiting for *Congress* to provide for some systematic plan of pro- lure, while the tentative experiments are continued.

Congressional Policy.

Concerning the policy of the committee on rivers and harbors, the chairman stated a delegation representing States bordering the Missouri river, in 1900, that "the ffic is very light, and the question has arisen whether we are justified in continuing appropriations for that stream. * * * We find that the appropriations for the ssouri have been expended very largely merely for the purpose of protecting the nks. * * * We question whether it is proper for this committee to bring in propriations for that purpose."

Certainly if revetting the banks improved the navigation there could be no question to the appropriations, yet the Missouri River Commission was abolished because the ults secured were not commensurate with the expenditures. In this connection it y be in order to note that while the railroads in this territory were gradually appro- ating the traffic of the river, the latter retaliated by encroaching upon the right of y of the railroads and threatened to cut a new channel and to leave the expensive dges in the air. To avoid this calamity the railroads were compelled to resort to nk revetments for some miles to protect their property, not to improve the naviga- n, and it is reported that "up to this date (January, 1907) all the protection work, luding the dike built by the Government, has failed, while all that built by the rail- d, except the upper and lower ends of the 1889 revetment at Cambridge, has stood."

The appropriations made in the present bill for the Mississippi are "for the build- of levees and for surveys * * * as shall best improve navigation." Also for building of the necessary dredgeboats as may be required to obtain and maintain a igable channel 250 feet wide and 9 feet deep at all seasons of the year.

Thus the policy of creating channels by dredging by plants owned and operated by

the Government, under the eight-hour law, is rapidly being extended, and to comp with which contractors are obliged to increase their bids or retire from the business.

In short, the sum of $32,000,000 is appropriated for a continuation of termi works which have been under way for from 20 to 50 years, or in efforts to secure ch nels by dredging which have no protection from the constant forces which cause th deterioration, and for which the results are but transient.

For the interior waterways $6,200,000 goes toward an additional canal and lock the Sault Ste. Marie, and $6,670,950 for the Detroit river to enlarge the channel, wh the Ohio, the Black Warrior and other rivers have secured over $6,000,000 betwe them.

Then follows some $17,000,000 for lesser works distributed between seaports a rivers, and $5,000,000 for new projects, of which $1,211,000 is for an approach t proposed harbor where there is no commerce nor any work in progress which is aw ing completion.

This brief analysis would indicate that the greatest amount of this bill is for tra fer points, where the freight must of necessity be stored or transshipped, and for t porary work, which requires constant appropriations for maintenance, so that actual transportation of freights by means of the interior waterways of the coun save on the great lakes, will not be materially enhanced by these allotments from public treasury. Even the Ohio and the other interior rivers are isolated improveme not continuous, and disconnected with any seaport, and it will require some 50 ye at the present rate before the 1065 miles of the Ohio have been deepened to the n foot draught now demanded. Under this condition of affairs it does not appear t even the waterways will be available at an early date for the relief of the railro which are now unable to deliver freight on time contracts.

The Freight Congestion.

The general elements affecting this problem are the population, tonnage, track yard facilities, motive power, rolling stock, lighterage and storage. Their mutual r tions may best be exhibited and compared by citing the statistics of growth for the ade 1895-1905 as given by the Statistical Abstract of the United States and compu the percentages of increase. The population is obtained from the previous diagr which is believed to be reliable:

Tabular Exhibit of Increments Between 1895 *and* 1905.

Elements.	1895.	1905.	Increase.	Per c
Population	69,458,470	86,128,871	16,670,401	2
Railroad Mileage:				
Single track	177,746	216,973	39,227	2
Second, third, fourth tracks	12,348	19,881	6,533	5
Yards and sidings	43,181	69,941	26,760	6
Total tracks	233,275	306,796	73,521	3
Tonnage carried	755,799,883	1,435,321,748	679,521,865	9
Ton-miles	88,567,770,801	187,375,621,537	98,807,850,736	11
Tons per mile	4,362	6,681	2,418	5
Rolling Stock:				
Locomotives	36,610	49,616	13,006	3
Freight cars	1,230,798	1,757,105	526,307	4
Tractive power	13,700	28,700	15,000	10
Freight-car capacity increased over	.....	.....	.....	12
Tons per capita	10	15	5	5
Ton-miles per capita	1,160	2,000	840	7
Miles per 10,000 of population	23.30	23.04	Less.	

The conclusions to be drawn from this exhibit are that while the mileage has kept pace even with the increase of population, the tonnage carried has act increased fivefold, while the density of traffic per mile has increased over 50 per

To render this result possible it has been necessary to build larger and heavier engines and cars, requiring much reconstruction of tracks and bridges and enlargement of tunnels. The tonnage per capita has increased 50 per cent. in the past 10 years, while the ton-mileage increased 72 per cent., indicating a gain in efficiency of 22 per cent.

Whilst the number of locomotives and cars have increased faster than the population, and far more slowly than the tonnage, yet the increase in tractive power and capacity have been greater than even the ton-mileage, but the inherent impossibility of utilizing them for transportation for a large part of the time greatly reduces their efficiency. It is found that the actual time which the cars can be employed in moving freight is but two hours out of the day, or one-twelfth of the time, and that the balance is consumed in the yards for storage or lading. Hence the larger the number of cars the greater the delays. This is not a recent development, for as long ago as 15 years the president of the Pennsylvania Railroad in his annual report stated that "the year 1892 presented the anomalous condition of a larger amount of traffic being tendered to the railways than they were properly able to handle, while, at the same time, the competition between the transportation lines of the country was more active and the traffic carried at lower rates than at any other period in their history."

In his startling address before the Merchants' Club of Chicago, November 10, 1906, President James J. Hill pertinently stated that the "growth in ton-mileage was 110 per cent. The growth in the mileage of railroads to handle that traffic was 20 per cent. There is where the whole country stands today. The traffic of the country is congested beyond imagination. The commerce of the country is paralyzed, and continued it means slow death." He then proceeds to show the practical impossibility of meeting the requirement for the necessary mileage and terminals, and says that the money required would be more than double the entire amount in circulation in the United States; that the total capacity of the rolling mills is 3,000,000 tons, of which 2,250,000 are required for renewals annually, and if the rails and the money were available it would not be possible to procure the labor to lay this additional trackage. As a last resort he therefore turns to the waterways and recommends a 15-foot canal to be built from St. Louis to New Orleans, and "the sooner it is built the better for the country." But in view of the financial condition of the public treasury, as set forth in the previous articles, and the insuperable difficulties attending the construction of these works under Government control, it would seem to be almost as hopeless a task as the construction of the additional tracks.

The most practicable solution of this remedy seems to be the one now being applied by New York, Illinois and other States, which are proceeding out of their own resources to construct the necessary watercourses for the relief of their own necessities, regardless of appropriations from the United States.

There appears, however, to be a possibility of further securing a large measure of relief by a readjustment of the tonnage and a segregation of the lower-grade tonnage to the canals and rivers which could readily be restored at small cost as auxiliaries to the railroads, and which might be built out of their earnings to relieve and cheapen the traffic. The tonnage of 1905 was composed of the following classes of commodities: products of agriculture, 10 per cent.; of animals, 1 per cent.; of mines, 53 per cent.; forests, 11 per cent.; of manufactures, 15 per cent.; of merchandise and other articles, 10 per cent. In 1905, of the 53 per cent. from the mines, nearly 500,000,000 tons were coal and coke, and 108,253,681 were ores. These materials were at one time, in the earlier history of the country, handled almost exclusively by water at much lower prices than are charged today, and it would seem to be a wise policy for the railroads

holding these waterways to restore them to their legitimate use and thus relieve their tracks and rolling stock for the higher class traffic.

From the diagram showing the character of the traffic carried by the railroads in 1905 it appears that the products of the mines composed the larger part of their tonnage, and, because of its relatively low value and the small margin available for transportation, the average haul must necessarily be short. The average of all commodities for the United States was found to be 130.45 miles in 1905, which, at the average charge of .78 cent per ton-mile, would make the charge for the average distance $1.02, which would seem to be about the limit for coal, especially of the lower grades.

The output of the coal mines of this country for 1905 was "384,598,643 short tons, having a value of $476,756,963."* From these figures there results an average value per ton of only $1.24, so that the margin for transportation must be very low, while the volume is larger than that of any other commodity. The distribution is also quite general, and the largest deposits of the East are accessible by water. The anthracite regions were opened by the Lehigh Navigation, the Schuylkill Navigation, the Delaware and Hudson Canal and the Union Canal, while the bituminous fields of Maryland and West Virginia were tapped by the Chesapeake and Ohio Canal, the Monongahela and Kanawha improvements and the Ohio Canal.

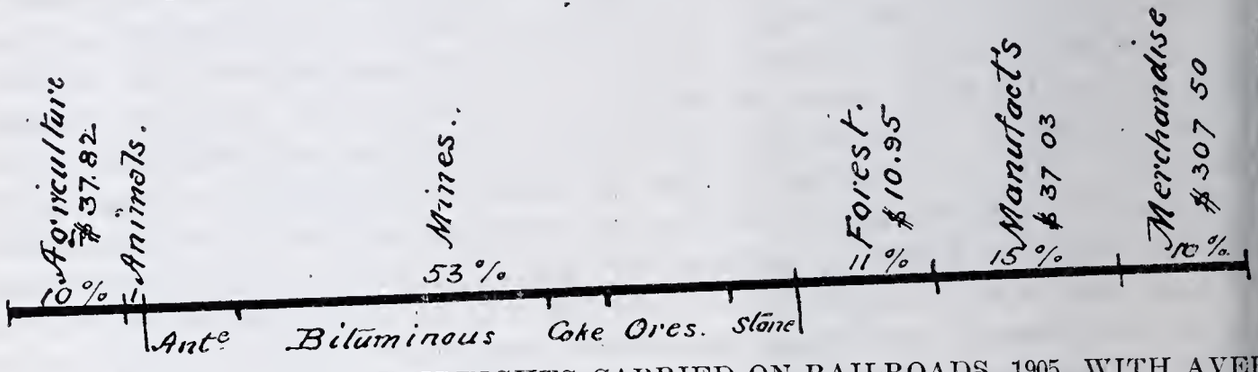

DIAGRAM OF CLASSIFIED FREIGHTS CARRIED ON RAILROADS, 1905, WITH AVERAGE VALUE PER TON.

As an illustration of the utility of the water rates, it may be stated that one Pittsburg firm, using between 2,000,000 and 3,000,000 tons of coal a year, saves $1,000,00 by securing its fuel by water instead of by rail.

There are still enormous areas of undeveloped coal reserves in the United States but they are so far removed from the centers of industries and the seaboard that it is unprofitable to utilize them under existing conditions of transportation. The factories must be installed at the mines and the manufactured product be conveyed to the market because of its higher value, which admits of the long haul. In short, the policy of the railroads must look for relief from engorgement by transferring these low-grade, bulky materials to other avenues of transportation and also to the creation of a larger number of terminal points with greater yardage and storage facilities, permitting the cars to be employed a larger percentage of the time on the road. The average haul of 130 miles can be made in about eight hours, yet the cars are held in the yards from six to eight days, which would give an efficiency of only about 6 per cent., and the more the number of cars is increased, without increase of track, etc., the greater the expense and obstruction. The railroad system would seem to have reached its limit in the effort to handle traffic in small units, and no amount of legislation will relieve the situation. Lowering rates by law will merely stimulate engorgement or drive some lines out of business and increase the tonnage on the survivors. Segregation of traffic is the most available

*See the *National Geographic Magazine*, Washington, D. C., February, 1907, article by R. Campbell, "How Long Will the Coal Reserves of the United States Last?"

remedy wherever it is practicable, and this entails the immediate restoration of the waterways to their fullest capacity.

Railroad Rate Regulation.

In a country covering the extent of the United States, with its great range of altitude, latitude and physical conditions, it is impracticable to attempt to establish general laws to regulate rates by legislation. The returns from every well-conducted business are supposed to be sufficient to pay all fixed charges and leave a fair percentage for interest on capital. The statistics show that for the bonds of railroads the dividend paid averages 3.65 per cent., and for the stock 3.02 per cent. This is not a very attractive showing for so large a capital. To attempt to fix a low maximum charge based upon present average conditions would be fatal to many roads, as a glance at the returns by groups will show the great differences which exist in cost of operation and maintenance due to mountains, plains, frost, snow, floods, character and amount of traffic, labor conditions and many other factors. Thus it is found that in New England Group I, where there is not sufficient food nor fuel to supply the local population of this manufacturing section, the average rail rate per ton-mile for freight is 1.167 cents, and the revenue per mile of road is $7.681.

In Group II, extending along the coast from New York to Maryland, inclusive, the rate is but little more than one-half of the former, or .667 cent, while the revenues per mile are almost double, or $14.010. For Group III, extending along the shores of the upper lakes, and where there is the cheapest water competition in the country, the ton-mile rate is still lower, namely, .607 cent, and the receipts are $8.833 per mile. This district embraces the States of Ohio, Indiana and Michigan, which are not connected with the seaboard, and hence the lesser returns per mile. From Virginia to South Carolina, Group IV, the rate is .691. In Group V, extending from Kentucky to the Gulf, and including Georgia and Florida, on the Atlantic, the average rate is .839. Between the lakes and the Missouri river, Group VI, it is .766. From the Missouri to the Rocky mountains, Group VII, it is .900. South of this, extending to the Red river and including Arkansas, Group VIII, it is .988. For Louisiana and Texas, Group IX, it rises to 1.096, and for the Pacific slope, Group X, it reaches to 1.098.

The variations are, therefore, almost 100 per cent., due to local conditions, and any effort to establish a fixed rate, say of one cent, as a maximum, would drive the population out of New England and close its plants. While New England is lacking in fuels, she has developed her water-powers to a large extent, but neglected her waterways for transportation, so that the higher rail rates are largely due to the manufactured goods created by the cheap power plants. On the other hand, the general prosperity of the lake group is due to the low rates on ores and fuel rendered possible by those inland seas, which have proven to be of so great value to the railroads skirting their unproductive areas. Group III, with half the rate of Group I, produces a larger return per ton-mile because of its low water competition, which has developed the great manufacturing establishments in that district.

Although the railroads of Texas charge over one cent per ton-mile, their returns are but $4.066 per mile, or less than half those of the lake region, with its ice and snow.

The same general features are observable as to the passenger rates. The lowest average is found to exist in Group II, where it is 1.722 cents per passenger mile, and the highest is in Group IX, Texas, where it reaches 2.283 cents, while the greatest return is in New England, where the passenger receipts per mile of road are $6.237. The reasons are manifest—distribution of population and numerous small centers of industry, generating greater mobility.

The average rate per passenger mile in the United States for 1905 was 1.962 cents, and it is evident that any effort to fix a maximum of two cents would work injury to a large section of the country and retard its development. The elements which have attracted population, and especially manufacturing plants, to certain sections, namely, cheap fuel and competitive transportation rates, should be more generally disseminated, that the traffic may be distributed more equitably and for the benefit of all the railroads, as it would enable them to conduct the business at less cost and greater profit for their shareholders. This result can best be obtained by opening up the magnificent waterways of the country, which are still slumbering in the lap of Nature, and utilizing the water-powers at the same time. In this respect the South country is signally blessed, but it has hitherto lacked the means to create the facilities which are so vital for the opening of her rich mines and agricultural wealth.

Taxes Paid by Railroads.

During the fiscal year ended June 30, 1905, the railroads of the country paid to the various States a total tax aggregating $63,324,551, which was made a part of the cost of transportation, and therefore entered into the rate. In other words, the people of the United States paid these taxes through the railroads acting as the agents or collectors for the several States. The tonnage tax on the Pennsylvania Railroad during its earlier days was found to be so oppressive a burden, in view of the fact that the State was maintaining its canals at public expense as competitors, that it became necessary for the railroad to secure control of the canal, as well as to regulate legislation, that it might be in position to maintain its existence and perform a public service. There would seem to be too much restrictive legislation not only in the way of our railroads, but in the path of our merchant marine and their waterways.

III

Much stress has been laid upon the enormous dividends paid by the Suez Canal since its acquisition by Great Britain, but these returns are comparatively small when contrasted with those which the earlier British canals paid in the ante-railroad days. In 1824 Mr. T. B. Cummings, surveyor, wrote concerning the returns of the canals in the Birmingham district: "The immense tonnage of coal, iron and earthenware have enabled one of the canals to pay an annual dividend of £140 upon an original share of £140, and as such has enhanced the value of each share from £140 to £3200, and another canal in the same district to pay an annual dividend of £160 upon the original share of £200, and the shares themselves have reached the value of £4600 each.

"Nor are these solitary instances. Mr. Sandars informs us that of the only two canals which unite Liverpool with Manchester, the 39 original proprietors of one of them, the Old Quay, have been paid for every other year, for nearly half a century, the *total amount of their investment*, and that a share of this canal, which cost only £7, has recently sold for £1250, and that with regard to the other, the late Duke of Bridgewater's, there is good reason to believe that the net income has for the last 20 years averaged nearly £100,000 per annum."

It was to control the canal monopoly and reduce their charges that railways were encouraged and Parliament was induced to pass an act in 1845 expressly sanctioning the control of the canals by the railway companies, whether by amalgamation, lease, purchase or guarantee, and a considerable amount of the canal mileage came into their possession. It was soon discovered, however, that the railway monopoly was as serious

an obstacle to traffic as the canals had been, so that this sanction was practically repealed by the railway and traffic acts of 1873 and 1888. By that time about one-third of the canals had been acquired by the railroad companies.

In 1886 the Bridgewater Navigation Co. sold the canal to the Manchester Ship Canal Co. for $8,500,000, and it is now an important asset of the latter company.

In 1761 the traffic between Manchester and Liverpool was about 2000 tons a year, while at the time of the starting of work on the Manchester Canal it was not less than 10,000,000 tons.

The records of the Delaware and Raritan Canal, after it had been in operation for about 30 years, in competition with the Camden & Amboy Railroad, show that it was carrying about 4,000,000 tons of freight, and that in 1866 the net revenues from the canal were $933,642 on a capital of $4,381,251, making a dividend of nearly 23 per cent. The operating expenses were only one-tenth those of the railroad of about the same length, which paid only about 5 per cent on its capital.

The Benefits of the Erie Canal.

The Erie Canal furnishes another illustration of the influence of a waterway in establishing the trade routes and commercial centers of a nation, for up to the date of the completion of that great work in 1825 Philadelphia was the most prosperous city of the Union.

But the opening of the canal soon transferred the ascendency to New York, and it became the most potent influence in American progress and civilization. The traffic rapidly increased from 1,250,000 tons between 1837 and 1847, and it so stimulated canals in general that by 1860 there were over 5000 miles in operation.

As first built it was but four feet deep, and was capable of passing boats of only 0 tons. In 1862 it was enlarged to a depth of seven feet, with boats of 240 tons capacity.

In the reports of the chief of engineers for 1874 the statement is made that "the entire cost of constructing the Erie Canal was nearly $39,000,000. This sum, with interest to 1863, amounted to $52,491,901. During the same period the gross receipts from tolls were nearly $72,000,000, and after deducting the expenses the net profits were $59,264,812, not only sufficient to pay the entire cost of construction with interest, but leaving a surplus of $7,000,000. *Five-sixths* of the gross income were net gain. Since 1862 the net earnings have been about $20,000,000 more. From that date to the end of the fiscal year 1868 the amount of tolls paid to the State was $25,260,384. No class of improvement, railroad or other, can make such an exhibit. The Erie Canal has not only paid for its construction, but makes itself a present to the State with about $27,000,000 net profits."

So generally were these great advantages appreciated as economic factors in the development of the prosperity of the State and nation that to still further stimulate them the State abolished all tolls in 1882 and assumed the cost of maintenance and operation from the public treasury. It has also subsequently expended $9,000,000 in still further enlarging the canal trunk to nine feet, and is now expending $101,000,000 to make a barge canal of 2000 tons, having a depth of 14 feet, in the expectation of retaining the traffic of the lake region, which is being diverted into other channels.

The great improvements made in the capacity of railroads, however, had its effect on the limited canals, so that while in 1860 the waterway carried 65 per cent. of the total tonnage passing through New York State, which was then 7,155,803 tons, in 1900 it carried only 4.1 per cent. of the total of 84,942,988 tons then transported. This makes the increase in the traffic of New York at the rate of 47 per cent. per decade,

or only about one-half of the increment for the entire railroad traffic of the United States during the last 10 years.

The statistics for New York are from the report of the State committee on canals, General F. V. Green, chairman.

The Louisville and Portland.

The agitation for a canal around the falls of the Ohio at Louisville was begun in 1802, but as Congress was not disposed to endorse it, the State of Kentucky granted a charter to a stock company in 1825, January 12. The capital was $1,000,000, represented by 10,000 shares of stock, of which the Government subscribed 2335 at par March 2, 1829. The canal was opened by a private corporation, and the first boat passed through December 22, 1830. The total cost, including the right of way, was $1,019,277.09. It was thought the dimensions were large enough for all time, but in 1852 only about one-half of the vessels could pass through the locks. The revenues from tolls during the first 11 years were $1,025,345, or more than the first cost.

In consequence of the opposition of shippers to the high tolls, the State passed an act on January 21, 1842, authorizing the directors to purchase the shares and transfer them to the United States, on condition that it should enlarge the canal and charge only enough to maintain and operate it. This provision was unanimously accepted by the company, which had paid out in dividends $822,539. The Government had received in cash $257,778 and a stock dividend of 500 shares, or about $80,000 more than it had put in. During the following 12 years the net receipts were applied to the purchase of the stock, which was bought at prices ranging from $149 to $251 per share, and the shares thus secured at a total cost of $1,419,062 were transferred to the Government gratis. Thus the Government had obtained without expense 9995 shares, while the five shares remaining in hands of the directors were held to enable them to continue the operation, as Congress refused to accept the management of the property. In consequence of the failure of the Government to ratify the act and accept the canal the State of Kentucky passed another act December 19, 1857, authorizing the directors to apply the revenues to the construction of a branch and the enlargement of the original canal and to make it free of tolls at an early period.

The Secretary of the Treasury had, however, forbidden the directors to use the revenues for the enlargement as authorized by the State, so that a committee of river interests submitted an appeal to Congress stating: "Our commerce has built and paid for this canal which the Government now owns and assumes to control.

"As matters now stand the Government of the United States is the *great impracticable* in the way of the improvement of the Ohio river. Virtually it is the obstruction at the falls, and not the rocks in the river's bed. These would crumble at the touch of private enterprise. Grasping its stock in the present canal, the Government issues its injunction against even the employment of its revenues in its amelioration."

On May 24, 1860, Congress ratified the Kentucky act, but prohibited the board from using the credit of the United States, whereupon the directors proceeded to enlarge the canal, and after expending about $1,825,403 they were obliged to suspend because of war prices. This was in 1866. In the meantime three surveys and reports were made by United States engineers, but no action was taken thereon. On March 29, 1867, a fourth survey and report was ordered to be made.

The enlarged canal was opened on February 26, 1872, and the Government finally assumed entire control on June 11, 1874. Tolls were abolished July 1, 1880. The total cost of the old canal was $1,140,000. The company expended on the enlargement $1,825,403 and the Government $1,450,000. Total cost to 1882 was $4,800,000.

The amount of tolls collected by the canal company from the date of opening in 1830 to 1874 was about $5,600,000. The amount collected under Government management was $417,069.38, making a total of more than $6,000,000 in 49½ years, or over $1,200,000 more than its entire cost, and about $3,400,000 more than it cost the Government. In closing his report General Weitzel remarks: "In view of these figures, no argument nor comment seems necessary."

In this same report stress is laid upon the superior importance of the commerce of the Ohio river, and it is shown that out of the total internal revenue of the country for the fiscal year 1881, amounting to $135,000,000, over $87,500,000 were paid by the Ohio basin. The progress of the improvements and the appropriations are wholly inadequate to meet the demands of its commerce.

The report also contains the significant statement as to the reason for lack of progress that "we are forbidden, and properly so, from urging appropriations for new works, and are limited solely to giving our views and estimates, when asked to do so, by the proper authority." From the above brief it appears that from the date of the early appeal to the Government for relief from this obstruction, in 1802, to the date of its final emancipation from tolls, about 78 years had elapsed.

Passing of the Monongahela Navigation Co.

This was a private company chartered by the State of Pennsylvania in 1836 to improve the Monongahela river, which traverses the extensive coal regions adjacent to Pittsburg. It built six dams with eight locks, creating a slackwater navigation of six feet depth for a distance of 84 miles, prior to 1872. Shipments of coal, which began in 1841, increased rapidly, and the tolls became so large as to call for their abolition by the public. Condemnation proceedings were authorized, and on July 1, 1897, after 56 years of service, the property was conveyed to the United States for the sum of $3,761,615.46. At that date the tonnage of the river was said to be 4,500,000 tons, or more than all the other tributaries of the Ohio taken collectively. The yearly revenues of the company just prior to the transfer were $296,523, which was nearly 15 per cent. on its cost, and the tonnage was increasing very rapidly each year. The opening up of these enormous deposits of fuel by private enterprise has made the Pittsburg district and the Ohio valley one of the most prosperous in the world for its iron and steel output. The benefit to the Government will be made apparent when it is stated that the cost of this work was but 44 cents per ton of traffic, and for which the United States paid only 82 cents, as compared with $2.60 at the falls of the Ohio, $5 for the Kentucky or $7 for the Illinois rivers, with the works incomplete.

Economics of the Lake System.

The story of the commercial development of the Great Lakes cannot be told in a few words, but it is without a parallel in the world, and its moral is so convincing that it demands a hearing.

The rapids of the Sault, at the outlet of Lake Superior, separated the rich copper, iron and silver ores of that district from the enormous coal fields of the Ohio region until communication was opened by private parties in 1856 by a 12-foot canal. It has been enlarged twice, and the depth is now 21 feet, but a still further enlargement is approved. The traffic has far surpassed the wildest expectations of its projectors, who predicted that the tonnage would never reach 40,000,000, but last year (1906) it was 51,751,080, and the average distance this freight was carried was 843 miles, at an average cost of .81 mills, as compared with the average freight charge by rail of .78 cent. Thus the saving per ton-mile by water was seven mills, which, applied to the

total tonnage carried 843 miles, would represent an economy of over $304,000,000. So that the saving due to the cheapest of water competition in one year is more than one-half of the total expenditures for waterway improvements in the entire United States from the beginning of the works by the Government. This is not a hypothetical possibility, but an actual fact, which has enabled this country to so greatly increase its yield of manufactured products. It has benefited the overland transportation interests enormously by stimulating the industries around the lake and Ohio river basins, for without this low cost of fuel they could not have existed. A $20,000,000 steel plant which was located beyond the influence of this rate was obliged to abandon its plant and move to the lake front to avoid rail rates and transfers.

If the 90,000 square miles of unproductive territory covered by the waters of these great basins could be drained and be converted into arable lands with no 20-foot navigation connecting them, the first objectors would be the railroads, for the manufacturing industries would be frozen out and the large cities would be reduced to the hamlets of an agricultural district.

It would also be a physical impossibility for the railroads to carry this tonnage in addition to the present traffic in the seven or eight months of navigation, and since the average value per ton is but $10.60, if one-half of this is available for transportation, at the average rate of .78 cents, it could be carried only 680 miles, instead of 843, as at present, so that many of the mills and furnaces would be outside of the transportation zones now reached by water.

In like manner the record of the old Illinois and Michigan Canal, which was opened in 1848, is reported to have saved to the people of Illinois $180,000,000 in the following 37 years, although the canal was very illy suited to the purposes for which it was designed.

These are but a few of the practical illustrations which might be cited extensively of the great benefits and economies which may be effected by modernized canals and waterways. But the question remains, How shall they be attained?

IV

In view of the urgency for relief and the great demand for large appropriations for all the departments of the Government, the question of looking to the Congress to provide the means for so extensive a system of works becomes very serious, and the probability of its satisfactory solution must depend upon the operation of the methods pursued during the past history of the republic.

Prior to the railroad era many efforts were made by the infant States to obtain aid from the Government for improvements which were of national importance, but they were, with few exceptions, rejected. Then it was the policy of the Government to encourage private initiative by contributions in a few cases to corporations to insure the completion of important works. Today this policy is reversed, and not only are all works made dependent upon the approval of Congress or of a military board, but in many cases the appropriation is contingent upon the contributions of lands or money by the localities desiring the improvement. This change of policy has sprung up since the development of the railway system, which has in general regarded the waterways of the country as injurious competitors, deserving only of extermination because of their inherent ability to carry freight at lower rates. This is evident from the uniform experience of the effects on rates produced by the existence of the Erie Canal in New York, where, just after the close of the Civil War, the relative rates in cents were as follows:

Year.	Lake and canal.	Lake and rail.	All rail.
1868	22.79	29	42.6 per bushel, wheat.
1904	4.71	5.02	11.11 " "

These show that the all-water rate, even with the transfer, was about one-half, or less, than the all-rail rate, and that both diminished rapidly with the great improvements made in the railway, while the canal was but slightly deepened.

Yet, notwithstanding this great discrepancy in rates in favor of the water route, the tonnage of the railroads in so-called "competition" therewith has increased far more rapidly than that of the canal, because the latter has not been modernized and enlarged, and yet these New York roads are able to charge a *higher* rate on freights than those of Pennsylvania, which have no such water competition. For this reason it is urged that the canals of Pennsylvania should not be restored as rate regulators nor for the public convenience.

The statement is officially made that "had the Pennsylvania on its lines east of Pittsburg and Erie received the same rate per ton-mile that the New York Central received for the year covered by this report, its increase in freight revenue alone would have been upwards of $6,500,000." And the author goes on to say that the people of New York are spending "hundreds of millions of dollars to keep down the rates of transportation on the great lines of railroads paralleling the canals," whereas the result is that the rates are actually increased and the railroads benefited by the existence of the Erie Canal.

The paradox is due to the greater facility given for transportation, which develops population and industries, thus creating a larger and better class of freight for the railroads without injury to the people. This is not a single instance, since the rates on the foreign roads where there are ample waterways, regulated by the Governments, are all much higher than those in the United States, reaching as high as 2.8 cents per ton-mile in Great Britain, 2.2 in France, 1.6 in Belgium, etc. The railroads of New York voluntarily entered the territory of the pre-existing Erie Canal to secure some of the traffic which it had generated, especially in passengers.

It would seem to be evident, therefore, that all waterways, and especially the cheapest, like the Great Lakes, are undoubtedly beneficial to the railroads, and in this critical time, when the traffic has outgrown the capacity of the overland carriers, the latter, as well as the public, would be greatly benefited by restoring the canals and waterways which have been so ruthlessly destroyed under the fallacious impression that they were ruinous competitors.

With this end in view, and with the natural jealousies existing between the several sections and cities of the Union all striving for commercial supremacy, it is not surprising that a distinguished member of the United States Senate once said "that if there is a worse system of conducting the improvements of rivers and harbors anywhere in the world than our own, I would like to know where it is."

With a single industry, representing the enormous sum of $16,219,572,845, opposed to waterways under the belief that they are detrimental to its interests, it is not surprising that the control of these works should have been gradually concentrated in the General Government, where the multitude of bills, the shortness of the session, the concentration of legislation in the hands of one or more members as to what policy shall be pursued by the dominant party, the ease with which a measure may be suppressed or talked to death, the shifting of responsibility by reference to an executive office with instructions to pigeon-hole, and the necessity of distributing the appropriations over a large extent of territory to secure the passage of bills, thus reducing the efficiency of the expenditures, are all factors in the present condition of the waterways of this country after some 40 years of experience, during which the mileage of the canals has diminished over 50 per cent., while the population has increased over 100 per cent. and the tonnage in a far greater ratio.

Legislation has barred the door to the rapid, systematic and economical development of our waterways, and it requires radical and general releases to restore the deceased watercourses and remedy the injury, but it seems like voting away patronage to authorize the States and localities to inaugurate works for their own relief and development. For purely local works within State limits, however, there can be no question as to the authority of the State to authorize and encourage such works.

Government Expenditures.

The following tabular statement of the expenditures made from the National Treasury for river and harbor improvements is very suggestive:

Years.	Amounts.	Years.	Amounts.	
1822-1830	$1,575,094 11	1860-1870	$12,721,929 87	10 years.
1830-1840	7,270,373 92	1870-1880	58,363,588 60	10 years.
1840-1850	1,472,735 48	1880-1890	95,151,040 08	10 years.
1850-1860	3,700,912 95	1890-1900	167,226,122 86	10 years.
		1900-1906	125,527,861 00	6 years.
Total	$14,019,116 46			

Up to the beginning of 1867 the total expenditures were $14,994,206.63, and yet the canal system of the country had been kept up to date, while since that time the total expenditures have amounted to $458,015,452. These expenditures, added to the appropriation carried by the act of 1907, give an aggregate to date for the improvement of the rivers and harbors of the country of $559,969,090, with approved projects said to exceed $400,000,000 awaiting appropriations from the National Treasury.

As illustrating the attitude of the vested interests toward the manner in which a large part of this money was applied, it would seem to be pertinent to cite the testimony of one of the most potent railroad presidents of late years concerning the improvement of the Mississippi river by the Government. He said: "I have read all of the arguments before Congress. The outlet system is correct, and the only way to deepen the Mississippi river. If that were done, what would become of not only my own, but all the other railroads coming to New York? They would be ruined, and for that reason I would favor the levee system, for so long as that be kept up there need be no fears of the Mississippi as a competitor."

As a sequel to this statement an influential railroad president, whose lines skirt the river, has added: "Twenty years ago there were carried 100,000 bales of cotton from Memphis to New Orleans, but since the railroads passed under one management not a single bale has passed down by boat." He gives the statistics of the traffic during the past decade as follows:

	1890.	1900.
Freight by river from all sources	1,306,290	450,49
Freight by railroads from all sources	3,557,744	6,852,06

The decline in river traffic in 10 years was 855,792 and the increase in rail traffi was 3,294,322 tons, due not only to the greater efficiency of the railroads, but to the absence of navigation at low stages, in consequence of the efforts to confine the flood to the bed of the stream by levees, which have caused shoaling and bed elevation, with additional caving of banks and sedimentation.* The attitude of the railroad journal toward waterway legislation is also set forth by an editorial published in 1888, of which the following is an extract:

"The improvement of the Texas harbors is not likely to appeal very strongly to the railroads east of the Mississippi river. Today they see freight which used to go directly across the continent taken by steamer to New Orleans and thence by rail to Denver and to Idaho and Oregon. Today the merchants of New York and Chicago are fightin

*See Report Mississippi River Commission, 1903, etc.

against the tendency to make them way stations, as far as certain important traffic is concerned, and it is not to be expected that the railroads centering in them will take the most disinterested view of Southwestern harbor improvements. * * * The Southwest ought to have, and doubtless will have, deep harbors on the Gulf coast, and the question is how to get them. Whether it should be by Federal aid or not we will not now stop to discuss, but decidedly it should not be so long as the harbor improvements are carried on as they now are. When something like the proposed bureau of harbors and waterways is established, and the work can be thoroughly studied and organized and appropriations can be intelligently made, much proper opposition to Government aid to such work will disappear."

These comments are as true today as when they were penned, and the need of such modifications is more cogent if the country is to hold its own in the contest for the world's traffic. The mere appropriation of larger sums from the National Treasury will not provide the necessary relief, as there is no personal responsibility for results and an absence of personal initiative on the part of the officials in charge; in fact, it would seem that the regulations adopted by the committees of Congress are designed to postpone and delay as far as possible the making of appropriations for works of this class. The docket is already so full that no new projects can be considered, and even the most imperative ones under construction must take their turn, from which it appears that Congress is quite as much congested as are the railroads.

No Government Aid in 1811.

While enormous strides have been made during the past century in the facilities of transportation, the demands today are far greater than they were in 1811, when the Empire State sought national aid and failed to secure it because of the fear that such an improvement would give too great power and influence to the Empire State.

In that case it was desired merely to secure a grant of public lands, to be redeemed in 20 years, but the commissioners in reporting the refusal of Congress to this reasonable request stated frankly that "it found another idea operating with baleful effect, though seldom and cautiously expressed. The population and resources of the State of New York furnish no pleasant reflection to men whose minds are imbued with State jealousy, and although the proposed canal must not only be of the highest importance to the Western States, as well as to the whole Union, it was obvious that an opinion of its superior benefits to this State was sedulously inculcated." To meet this feeling the commissioners prepared a general bill, in connection with the Secretary of the Treasury, setting aside 9,900,000 acres of the public domain and appropriating it to the various water routes which were projected to cover all of the States, to give them an interest in the patronage, but even this was not effective in passing the measure, for some members did not wish to hazard their prospects for a re-election by voting either for or against the log-rolling bill, so that it was pigeon-holed, and New York, as well as other States, were obliged to make local appropriations for the opening up of the waterways which have contributed so greatly to the welfare of the nation, under State charters.

The same dilatory tactics have prevailed in the later efforts which have been made to secure congressional aid in the enlargement of these important avenues of trade, some of which have been on the tapis for more than a half-century, and others are under way, but with no prospect of completion for even the present draught within 50 years.

In view of the above facts, it is almost hopeless to expect to secure early relief from Government sources, and as Congress had power only over interstate commerce, it must devolve upon the State to apply its own revenues to the improvement of its own internal

ways of communication, as is the present practice of most of them, in the building of roads and railroads, as well as for waterways in a few instances.

Interstate commerce is even now not under full control by the National Government, it would seem, since it is possible for a corporation of one State to lease the highways of commerce in other States and place an embargo on them for 999 years, destroy their usefulness and divert the tonnage to a more expensive system, for which the public must pay the higher costs, and also when such corporation can secure the passage of foreign legislation prohibiting the construction of canals of more than three miles in length and preventing them from entering any city, town or borough of said State. Such legislation is in violation of public utilities and an injury to the State and nation, yet it has stood upon the statute-books for over 30 years. In other cases States have passed acts prohibiting the construction of ship canals within their borders. When the merchants, manufacturers and people of the country generally realize that the highways are an integral part of their business and rights they will then demand the enactment of legislation which will enable any location, desiring the removal of obstacles to communication with the outside world, to apply its own resources to the work, so that it may secure immediate results at the least cost.

Paternalism is enervating and obstructive. Local initiative is stimulating and progressive.

V

During the early days of the republic population was confined to the territory bordering upon the waterways of the Eastern seaboard, but the opening of the Erie and other canals and the building of railroads rapidly shifted its center to the Ohio and Mississippi valleys and created new lines of transit to the nearest seaboard. This movement is still in progress and the increasing productivity of the country causes a longer haul and a greater tonnage to be carried to the sea, thus creating new conditions which have surpassed the capacity of the overland carriers. Instead of a mere local question, transportation is now a national one, and involves a consideration of the dimensions and physical features of the entire country for its systematic relief.

During the past century the center of population has moved along the 39th degree of latitude from the vicinity of Baltimore, Md., to near Columbus, Ind., a distance of more than 500 miles, and having thus passed far beyond the Alleghenies, the line of least resistance for exports would be along the down-grade rivers to the Gulf of Mexico.

To counteract this tendency the Eastern interests have spared no expense to reduce the cost of transportation to the Atlantic seaboard by improvements of alignment, grade and distance, and the State of New York has several times enlarged the Erie Canal, while the Canadian waterways have been deepened far beyond those of this country, and they are of great importance in holding the traffic of the Lakes and the St. Lawrence for that Dominion.

These factors have long militated against the improvement of the Southern outlets for the products of the Great Basin, but the time has arrived when they can no longer be ignored, and the opening of the ports on the Gulf is even now of great service to the railroads in relieving the congestion by the shorter haul and greater dispatch.

The Great Basin.

Although the Government secured control of the outlet of the Mississippi valley in 1803, it was not until 1879 that a navigable channel deep enough for modern vessels was opened through the South Pass by Capt. Jas. B. Eads, and although very large sums have been expended upon the river with a view to increasing its navigability, i

has been shown already that it is not navigable at low stages, and that the system in vogue has been encouraged by hostile interests to retain the traffic on the eastbound routes. It is now seriously proposed to construct an artificial waterway from St. Louis to the Gulf, which shall have a navigable depth of 15 feet to supplement the great river from which the traffic has been diverted by the railways.

The rivers of this valley cover some 16,000 miles in length, and have created the most productive territory in the United States, yet they are only navigable in times of flood and high water, and these stages are becoming more uncertain every year because of the deforestation of their tributaries and the confining of the sediment to the bed of the stream. Fortunately, the Government has inaugurated the policy of irrigation, and the States are giving more attention to reforestation as a productive industry, so that there will be some measure of relief from the destructive natural forces which have been allowed to injure the highways of commerce, but there is not yet made any provision for a return to the valley of the fertilizing soils which are confined to the pathway of commerce, where they are not needed. At the mouth of the river, where several crevasses have not been closed, the sediment which has escaped from the stream has contributed over 160 square miles of rich arable land to the State and nation which it would have cost over $150,000,000 to have placed there by dredging. Each year about 18 per cent. of this alluvion escapes through these crevasses and thus prevents the more rapid extension of the bars into the Gulf and the reduction of the slope of the stream and menace from floods.

Economic Value of the Waterways.

The absence of a constant channel in the valleys of the Mississippi and its tributaries costs the country untold millions, but some idea of the losses to the farmer and the effect on the value of property remote from the seaboard may be seen from the statistics of the value of the cereal crops on the farm as furnished by the Agricultural Department for a period of 10 years. These values may be shown better by a chart, upon which may be placed the average price for wheat (for example) in each State, and by drawing the curves of equal values, beginning with the lowest and increasing by five cents each, it will be seen that the area of least value is that most remote from the seaboard, and that the cost of transportation must be deducted from the price at the farm that the product may reach the port at the export rate. So that the nearest port is the natural outlet, and it is inevitable that with equal facilities and local charges the Gulf ports must capture the bulk of the business of the great West. What this means to a single State may be shown by a brief comparison.

In 1901 the State of Kansas produced 99,079,304 bushels of wheat, while Nebraska raised 42,006,885 bushels. The yield in Kansas being 1.4 bushels per acre greater than in Nebraska, the price, under the law of supply and demand, should have been lower, but it was five cents higher. Comparing the rail hauls from Kansas City and Omaha, the principal shipping ports of these States, it is found that the former is 34 miles nearer Chicago and 129 miles nearer St. Louis, and by water it is 230 miles nearer the river route to New Orleans, so that this gain in five cents per bushel for that year, on a yield of 18.5 bushels per acre, represents a net revenue of 92.5 cents per acre over Nebraska. Had the entire State been sown in wheat it would have produced an additional revenue of nearly $50,000,000. The actual return on this crop above that for Nebraska was nearly $5,000,000. Kansas received nine cents more per bushel on her corn and six cents more on oats, making a total net gain of nearly $12,000,000, while on her crops Nebraska lost over $14,000,000 because of her geographical position with reference to waterways. The area of lowest prices covers the upper Missouri and the

Platte rivers in the semi-arid zone, and the curves show the increase in value as the coast is approached, so that the consumers near the seaboard must pay more for the privilege of their proximity to the foreign markets. It is just as important, therefore, for the interior sections to secure navigable channels as it is for those bordering the coast, yet it has been the custom of members from the States having few waterways to decry the appropriation for their improvement because little or none of these funds may be expended within their districts.

It is of the utmost importance that the improvement of the waterways should be pushed as rapidly as possible into the heart of the country, to carry out its agricultural and mining products to the people of the world. Today millions of miserable souls are starving in China, Russia and India, while the abundant harvests of our Northwest are unable to be handled and are going to waste.

After more than a century of control with an ever-varying personnel in charge, would it not seem to be a wiser policy to create a permanent board to apply the resources of the Government to the improvement of the low-water channels of the rivers of the West than to the reclamation of the lands from floods? This will follow as a sequence from the improvement of the stream and the levees will not have to be raised continuously to keep pace with the rising torrents.

The Great Belt Waterway.

For an efficient and cheap system of transportation it is necessary that a capacious channel should be constructed to connect the waters of the Great Basin with those of the Lakes, and for many years the early settlers gave their attention to this problem, so that numerous canals were built between the Lakes and the Ohio and Mississippi, as well as from Lake Erie to the Atlantic. The limited resources and sparse population restricted them to about four feet depth, yet they were fostered by the States and served a useful purpose, but they were soon supplantd in most cases by the rapid encroachments of the railroads, which in a few years exterminated over 700 miles of canals in Pennsylvania and 200 in Ohio. These connecting canals were so important that a brief description is submitted.*

The one connecting Lake Michigan with the Illinois river was 96½ miles long, 60 feet wide and 6 feet deep. There were 17 locks, each 110 feet long by 18 feet wide, and the total lockage was 158 feet. From La Salle, where the canal joins the river, it is 213 miles to the Mississippi, thus making the total distance from Chicago 309.5 miles. The Illinois was navigable for flatboats all the year save for ice, and for steamboats about four months. The summit level of the original canal has been removed and the waterway enlarged to 22 feet in depth by 160 feet in width in rock, and 202 feet in earth. This work has been built by a tax on the drainage district of Chicago at a cost of about $40,000,000, authorized by the State.

The *Wabash and Erie Canal* connects the lake at Toledo with the Wabash river at the town of Terre Haute, 275 miles from the lake and 290 miles from the mouth of the Wabash river, which is 130 miles above the mouth of the Ohio, making the total distance from the lake to the Ohio by this route 565 miles. There is a branch canal leaving the main line at Junction, about 75 miles west of Toledo and connecting with the *Miami Canal* from Cincinnati, extending up the Miami river. This canal is 160 miles long, 40 feet wide at the surface and 4 feet deep. It has 85 locks, 90x15 feet, the same as for the Wabash, and the total length from the Ohio to the lake is 225 miles.

Another, the *Ohio and Erie Canal* (built 1825-32), started from Portsmouth, at the

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*See Ex. Doc. No. 19, Thirtieth Congress, first session, 1848; report by Col. A. J. Alert, topographical engineers.

mouth of the Scioto river, and followed up that stream to Columbus, below which it trended eastward to the Muskingum valley, and thence via the Sandy northward to Cleveland, a total distance of 309 miles. A branch leaves this canal at Bolivar, 80 miles south of Cleveland, and extends eastwardly to Liverpool, at the mouth of the Little Beaver, on the Ohio, a distance of 76 miles, making the total distance from Cleveland to Liverpool 156 miles. This is known as the *Sandy and Beaver Canal.*

Still another, known as the *Beaver and Erie*, left the Ohio at the mouth of the Beaver river and passed up the Shenango in a northerly direction, crossing the lake divide to the headwaters of the Conneaut, thence down to the city of Erie, a distance of 136 miles from the Ohio, being the shortest of all these routes, but the total lockage was 929.5 feet, and the trunk was 40x4 feet, with locks 90x15. This canal was joined to the Ohio and Erie by a cross-country route of 83 miles in length, connecting Akron with New Castle.

The *Welland Canal*, connecting Lakes Erie and Superior, furnishes the outlet for the previous waterways between the Great Basin and the St. Lawrence through foreign territory. It is 27 miles long, and has 25 locks, with a total lockage of 327 feet. It was constructed in 1833, and enlarged in 1871 and again in 1900 at a total cost of about $25,000,000. It is 14 feet deep and 100 feet wide.

The eastern outlet within the United States is effected by means of the Erie Canal through the State of New York, a distance of 504 miles. The total lockage is 624.89 feet. It was originally only 40 feet wide and 4 feet deep and had 84 locks, 90x15 feet.

Other eastern outlets were from the Erie Canal at Utica via the Chenango to the Susquehanna and thence to the Pennsylvania canals. Another route was from Rochester via the Genessee valley to Olean, at the head of boat navigation on the Allegheny, which was 120 miles long, with 114 locks, and another by way of the Seneca and Chemung canals to the Williamsport & Elmira Railroad and Susquehanna Canal to tidewater, and finally by the Pennsylvania canals and railroads from Pittsburg to Philadelphia, 394 miles.

These canals across the lake and Ohio divide were amongst the greatest works of the early thirties of the last century, and resulted in converting Ohio from a State of barbarism to one of civilization and increased the price of lands from 300 to 400 per cent. They also made the improvement of the Ohio a necessity, for in 1837 it was only about 12 inches deep on the bars at low water, and it was proposed to increase it to two and one-half feet by wing dams and dredging.

The first appropriations for the Ohio were made by Pennsylvania in 1817, when $2000 were expended in "viewing the river," followed by $15,000 for its improvement as far down as Wheeling. Congress began appropriations in 1826, which amounted to $453,500 by 1839, when they ceased for six years and the public property was sold off to pay the debts and the United States engineer, Capt. John Sanders, transferred to other duties. The Pennsylvania Railroad, which was opened through to Pittsburg on December 10, 1852, then took up the issue and secured a charter, organized a company and made a tender to open the river for the benefit of its railroad to the seaboard, but it did not receive the sanction of the Government. Other efforts were made by Chas. Ellet, W. Milnor Roberts, Herman Haupt, chief engineer Pennsylvania Railroad Co., and others, but they met with a similar fate, and it was not until 1878 that the Government began the construction of a system of movable dams, on the Chanoine-Pasqueau plans, that an effort was made to create a six-foot stage by the erection of the dam at Davis' Island, a few miles below Pittsburg, to create a pool for the assembly of coal fleets awaiting floods to carry them down the river. This dam was completed in seven years at a cost of nearly $1,000,000, and served to float an assemblage of coal

barges from the Monongahela fields, containing 1,200,000 tons of coal, valued at $6,000,000, including the floating plant, for a period of six months, until a storm released it just prior to the close of the season by ice. The present condition of this most important highway of commerce is succinctly stated by Hon. Jos. E. Ransdell, M. C. of Louisiana, who is also the president of the National Rivers and Harbors Congress, as follows:

"In 1875-76, some 31 years ago, a project providing for a six-foot slackwater navigation on the Ohio was adopted and work begun thereon. It has proceeded with a snail's pace. Out of 52 locks and dams provided for in this project, only six have been completed, and four others are in process of construction. The project has been changed to a nine-foot depth instead of six, and the estimated cost of completion is $63,000,000. If this gigantic and most meritorious work is continued at the same rate as for the past 30 years, it will not be closed by the end of the century. * * * At the present rate we may hope to see the Ohio canalized in about 50 years."

Certainly this is a gloomy outlook for this trunk-line waterway, and even if it be opened to the Mississippi at that date for the 1000 miles of its course, there remains another 1000 down that stream to the Gulf to complete the circuit to the sea. It is difficult to determine the number of officials in charge of these improvements under the various administrations, but there have been no less than twoscore, aside from numerous boards, and the total amount appropriated for the river above Louisville from 1826 to 1900 has been only $16,919,542. At this rate the annual appropriations were about $230,000 for the 74 years, or three centuries to expend the $63,000,000 proposed. Even at the rate of $1,000,000 per annum it will take more than 50 years to complete the nine-foot stage, at least, and by that date the population of the country will have far more than doubled.

In the meantime the congestion in and around Pittsburg will have made it necessary to relieve itself by opening the shortest, largest and cheapest possible outlet across the lake barrier by the canal from Beaver to Ashtabula, a distance of 105 miles, with a depth of not less than 14 feet, in keeping with the gauge of the new Erie and Welland canals, thus bringing the entire Atlantic and Lake systems into communication with the extensive coal deposits and manufacturing developments of the upper Ohio and its tributaries. This work could be completed by private capital under the National Charter, which it required about 10 years to secure, in five or six years, if well organized. It is one of the most urgent works in the country, and will do much to relieve the congestion and cheapen the cost of fuel.

The loss due to the failure to maintain and modernize the waterways constructed in the past century is inestimable, and the progress of the nation in the effort to improve the interior routes is so unsatisfactory as to call for some radical reorganization of the methods pursued, if the demands of the country are soon to be met.

These conditions would seem to be fulfilled most expeditiously by subdividing the territory into drainage basins, having permanent officials located in each district and held responsible for the results, as is the practice in many foreign countries where the waterways are so fully developed.

VI

During the past century the turnpikes and canals built by syndicates or States were largely superseded by the railroads, which have now, in their turn, reached a limit beyond which safety and expedition appear to be unable to pass, and a return to the supplementary systems seems to be not only welcomed, but urged by railroad managers.

But these older feeders and outlets are no longer available, and must be extensively

rehabilitated, so that the important question arises as to the cheapest and quickest method of accomplishing this result.

Some few of the difficulties of securing appropriations and of conducting works of river and harbor improvements under Government control have been referred to in former papers, and the fact that the mileage of the canals has been reduced to less than half that prior to the war indicates that it is not probable that immediate relief can be expected from this source for many years under the existing conditions.

In a memorial from the civil engineers of the United States to the President, made 20 years ago, it was pointed out that:

"By the desultory and unsystematic methods of river and harbor improvements which have prevailed in this country up to this time, neither the harbors nor the rivers are at all adequate to the needs of commerce. The navigable waterways at present are in detached lengths, and not suited to economical transportation, and many are useless for a large part of the year. They should constitute connected systems, so planned as to avoid transshipments. The value of these commercial channels is gradually but surely impressing itself upon our people. All admit their cheapness for heavy traffic.

"The methods pursued in the prosecution of our national public works have been variable and unsystematic. Appropriations have been secured most largely through local and sectional influence. The evils attendant upon the inception in Congress of these works and in the introduction of various local schemes and projects are well understood. The waste of time in their discussion, the local jealousies, the contests by members zealous for the interests of their districts and the danger of failure or of a veto are rightfully looked upon by an intelligent public as unworthy of approval.

"In the execution of the works also there are many serious faults committed because assigned to military officers or detached service who have had no special training for the technical work placed in their charge, and whose duties are administrative rather than executive, with no power to initiate improvements, but merely to advise and carry out orders. Their tenure in this work is but temporary. They are *military* specialists assigned to *civil* duties. In case of war these duties must be suspended or civilians must take their place in the field (as was done in the Spanish-American War) which is unjustifiable."

This memorial contained a digest of the foreign organizations, and submitted a system admirably adapted to the requirements of so large a country as this, but it was premature, as the importance of the waterway was not then fully realized.

But the expense of maintaining so large an establishment as would be necessary for efficient work in all parts of the country, and the fear that the many officers now detailed on civil works might not be as advantageously employed, would make the passage of such a bill as difficult as it has been to relieve our merchant marine.

The mere increase of the appropriations, under the present limited force and routine of bureaus, without competition in methods or plans and with no responsibility for the permanency of the results, does not hold out much promise for relief, as judged from past experience extending over 40 years.

The short cut to an immediate restoration of the waterways would seem to lie in the return to the system which worked so admirably in the ante-bellum days when the works were conducted by the States or by corporations chartered by them, at least in so far as the lesser local rivers and canals are concerned, and which improvements may be executed simultaneously with the larger harbor and trunk line, river or lake routes under Government supervision and control, as at present. Thus there would be no additional drain on the National Treasury, and the localities which have been denied the right to relieve their own necessities would speedily undertake such works at their

own expense as commercial projects, and when the traffic is fully developed, if the tolls be found onerous or obstructive, they could be emancipated, as is now the practice, by condemnation. The works thus acquired are in fact the most valuable in the country, and they have been built in less time and for less money than those of much less importance. An open door and a healthful competition will soon afford great relief to the engorged transportation and other industries of the nation.

The Market Range.

By this is meant the distance which any commodity may be carried before the margin between the cost of its production and the consumer's price is absorbed by the charges of placing it on the market. A large part of this charge is expended in transportation, and as the margin for raw material, which is of low value, is small, the distance which it can be profitably moved is correspondingly limited unless the traffic rate is very low. As this is the vital factor, the importance of the water rates will be evident by a mere statement of the relative charges on or over the various media used for transportation. Thus it has been ascertained from official data, carefully compiled, that the average cost of moving one ton one mile is as follows:

On earth roads, by animal power, 25 cents per ton-mile.

On railroads (1906), 7.8 mills per ton-mile.

On canals, from two to three mills per ton-mile.

On rivers and slackwater navigation, about one mill per ton-mile.

On the lakes and broad ocean, less than three-fourths mill per ton-mile.

If the ocean rate of, say, one-half mill, be taken as the unit of comparison, then the river will be represented by 2, the canal by 5, the railroad by 15 and the road by 500, thus demonstrating the superiority of the waterways over the other systems.

But even these low rates are surpassed when the Western rivers are in flood stages and furnish from 8 to 10 feet of water for the transportation of coal from Pittsburg to New Orleans, a distance of 2000 miles, at a cost of 75 cents per ton, including the return of the empty boats. This is less than four-tenths of a mill per mile.

The average market range of the traffic through the St. Mary's canals can readily be found by dividing its average value of $9.42 by the rate per ton-mile; but as only the "margin" over cost of production is available for this purpose, if it be taken at, say, $4, the distance it could be carried by rail at the rate charged between Lake Erie and the Ohio river, the haul would be limited to only 444 miles.

The contract rates on the lakes has been 82 cents per 1000 miles, and for the haul over the divide it was $1.15 for 130 miles, making a total of about $2 for transportation out of the $9.42 of value.

At the average rail rate of the United States to carry a ton of freight across the 3000 miles separating the Atlantic from the Pacific the charge would be $23.40, so that it is apparently impossible to conduct a very large part of such traffic at a profit, since the margin will not admit of such a tax. If half of the value be assumed to be available for carriage, it would exclude forest products as a class, having an average value available for transportation of $5.50, while agricultural products would yield only $19 and manufactures but $18.50. The only class which furnishes a sufficient margin for so long a haul is merchandise, the half-value of which is $153 per ton. Yet even this class is shipped as far as possible by water, both for economy and dispatch. The most profitable business of the railroads is, therefore, in collecting and distributing freights for short distances between commercial and manufacturing centers which may be able to receive their raw materials and fuel at water rates. The average haul for the United States is but 130.45 miles.

The Great Belt Route.

Hence the great necessity of the early opening of the Great Belt Waterway through the most densely-settled sections of the country from New York through the Great Lakes, to the Illinois and Michigan Canal, and thence via the Illinois and Mississippi rivers to the Gulf of Mexico, a distance of about 3000 miles, of which only about one-third is available for vessels of over eight feet draught.

This is the great work so well begun by the State of Illinois in the Chicago Drainage Canal, built at local expense for the double purpose of providing both drainage and navigation for the dense population at the head of lake navigation.

The Southern Outlet via the Mississippi.

Another equally important link is the possible one via the Lake Erie and Ohio Canal and river, which is about 30 per cent. shorter and avoids the detour around the Michigan peninsula in high latitudes, where the closed season is longer. The slow progress made on the Ohio river improvement, however, does not give encouragement of early relief from this source, as compared with the progress on the Illinois river.

To avoid this 720-mile detour, requiring three days for a 10-knot steamer, it has long been contemplated to build a ship canal across the base of the peninsula from Chicago to Toledo, which would be about 160 miles in length and require, at a speed of four miles an hour, 40 hours for the canal portion, to which should be added six for the transit of Lake Michigan and additional time for lockage, making the saving in time only a few hours, while the expenses of maintenance would add to the cost as compared with the open water channel already available. The estimated cost of the waterway is placed at $100,000,000, and it would justify its existence, not because of the through traffic, but by the local industries which it would attract and the traffic resulting therefrom. The canal would doubtless be closed by ice from three to five months during the year.

The Levees and Navigation.

But these Western outlets to the Gulf are all dependent upon the creation of a satisfactory channel down the valley, either along the river bed or independent thereof. The latter would cost about $200,000,000 to construct, while the river, a natural channel, is available for a large part of the year. The imperative need of the country is to so improve its channel as to make it available for navigation at all seasons. For this purpose a mixed commission was created June 28, 1879, and the New Orleans *Picayune*, under the caption, "Fighting the Mississippi," thus sums up the situation:*

"For many years the work was done and the money furnished by the people themselves of the lowlands, but finally the National Government, through the Mississippi River Commission, aided with funds and labor the great work of *protection*, and it is a matter of rejoicing that so great a degree of success has crowned the united labors.

"But this victory is *not the end of the fight.* The barrier must be built *higher, broader, stronger*, until the millions of people depending on it for protection shall be able, in the fullness of their confidence, to rest behind their bulwarks without a shadow of uneasiness lest this mightiest river of all densely-inhabited regions shall break its barriers and pour out death and destruction. But a great victory has been gained, and it is now with confidence that the struggle will be continued."

While it is true that 2000 miles on both sides of the river have been fenced out by the combined forces of the Government, the States and the parishes, it is likewise true that these levees have risen from about *four* feet to over *twenty*, and that large areas

*See the MANUFACTURERS' RECORD March 28, 1907 Italics ours.

have been reclaimed from overflow, with greatly-enhanced values, thus increasing the output of agricultural products from this fertile region.

But it is not the duty of the commission nor of the Government to reclaim land in order to "regulate commerce between the several States," unless it can be shown that such reclamation works improved the navigation, which it is not claimed has been the result. It has confined the water and mud at flood stages to the bed of the stream, and thus arrested the fertilization process which formerly built up this extensive garden, and the *Picayune* frankly and truly states that the struggle must go on to protect life and property. Already it is necessary to resort to irrigation and pumping to take the place of the former natural water supply, and no relief is provided for the rapid voiding of the engorged river, as the outlets are being rapidly closed below Red river.

So vital is this question that it seems to justify a few references to past experience as indicating the futility of repeating them, as is constantly being done, without beneficial results.

To Open the Outlets.

To systematically improve a river its mouth must be made large enough to void the greatest floods, as Nature attempts to do in the various distributaries of the delta. To overcome the "bars" thus deposited in the channels at the outlets numerous efforts have been made by the Government for more than 50 years, to secure a reasonably deep and permanent channel. In 1874 it was reported that "to maintain an 18 to 20-foot channel 250 feet wide by dredging would cost $200,000, and one 400 feet wide probably $400,000 a year. This is the maximum effect to be expected from dredging." The board, with only one exception, Gen. J. G. Barnard, was therefore in favor of building the Fort St. Philip Canal, which was only prevented by the proposition of Capt. Jas. B. Eads to open the mouth of the river to 30 feet by giving his guarantee for the results which he secured by 1879. Prior to that date it was officially stated that there were "no reliable outlets, and it can never, at any cost, have such an outlet or mouth." "A ship of 1000 tons pays for towage in and out $1043, and the annual tax on New Orleans commerce is $2,000,000." Since the opening of the South Pass the size of the vessel has grown to such an extent as to require more water, and several plans have been submitted for the improvement of the Southwest Pass, which have been modified from time to time; the original one, estimated to cost $13,000,000, was set aside for one of $6,000,000, supplemented by dredging over 22,000,000 cubic yards of silt at four cents per yard, regardless of the enormous volume being annually deposited by the river. This plan was again changed, all in consequence of a competitive plan submitted by a civil engineer, who stood ready to guarantee a 40-foot channel for $6,000,000, but his plan was not recommended to Congress, and the two-jetty plan was let by contract, which is now almost completed, with the result predicted by the board of 1874 as to the impossibility of securing more than 18 to 20 feet by dredging between them.

VII

The great importance of adopting some definite policy for the permanent improvement of the river has long been felt, and to this end members of Congress have appealed for voluntary expressions of professional opinions from those civil engineers who were supposed to have knowledge of these matters, and many excellent recommendations were submitted to Congress in consequence, but the system in vogue has not permitted their introduction by that body.

In October, 1887, a prominent member from a State bordering the river wrote as follows: "I wish to get the opinions of civil engineers of known ability about matters

ertaining to some of the civil works now being conducted by the General Government, nd I would be glad if you would promptly send me a reply to the following questions:

"1. What difference is there, from an engineer's standpoint, in the policy called or in the following paragraphs:

"(a) That the method of improvement of the navigation of the Mississippi river, which promises the most valuable results, will comprise as its essential features the contraction by suitable works of the waterway in the wide portions of the river, and the protection of caving banks by special means, whenever the contracting works referred to do not effect that result.

"(b) That no work of bank protection shall be executed in said reaches or elsewhere until after it shall be found that the completion of the permeable contracting works and uniform width of the high-water channel will not secure the desired stability of the river banks.

"2. Do you consider the high-water treatment and jetty system as set forth in the Mississippi River Commission's report of 1880, and subsequently adopted by Congress, as the best plan for the improvement of that river?

"3. Do you think the commission has seriously departed from that plan?

"4. (Applies to effects of the Atchafalaya outlet.)

"5. Assuming that the commission has changed substantially to the revetment system instead of adhering to the "jetty system," do you think that they can succeed under the new plan within the limits of the pecuniary resources of this country, and if so, at what probable cost can they thus achieve and maintain thorough improvements?"

In view of the frequent changes of general policy and the final recourse to dredging in the effort to secure a low-water channel of nine feet, the report of the commission for 1903 is peculiarly significant when it states that the commission is continually making experiments looking to the best use of available material "when Congress shall provide for such a systematic improvement."

It is not possible in this brief communication to discuss fully the best methods of creating a low-water channel in this great stream, yet a few suggestions may be submitted from a letter addressed to Hon. T. E. Burton, chairman of the committee having it in charge, in response to his statement, "I would rather have the Mississippi river improved from St. Louis to New Orleans than from thence to the Gulf."

The following reply was made November 26, 1900, and covers the situation today: "The Mississippi is no exception to physical law, and must be treated as a whole. The first commission proposed to canalize the stream by contractions in the wide reaches. The next proposed revetments of banks which was purely local, having no effect in regulating the volume of the stream or preventing great fluctuations of stage and velocity. The next departure was to close up the natural depositories of the sediment by levees, thus confining all the water and its mud to the narrow bed, requiring still higher levees. The latest change has been the use of hydraulic dredges, whereby the silt was pumped temporarily from one part of the bed to another.

"None of these are sufficient, nor are they radical improvements giving promise of permanent relief. * * *

"The most permanent and best results for navigation are secured by uniformity of stage and alignment * * * so that the problem reduces itself to the one of regulating the volume of discharge which may be accomplished by three auxiliary devices, viz., by restraining the floods in the tributaries by reforestation and reservoirs, which is now being done to a large extent; by impounding the excess of the floods en route in large lateral reservoirs covering the St. Francis and other swampy regions, as was

so admirably developed in the report of the Illinois River Valley Association of this year by Messrs. Seddon, Cooley and Randolph, who are thoroughly familiar with the river from long experience, and lastly, by opening up all possible avenues of escape in the lower reaches to permit the rapid voiding of the floods and their contained sediment. This combination will give the best results and conform as nearly as possible to nature's methods, but, unfortunately, only the first of the above conditions has been in part installed, and the other two are sadly violated.

"A mere glance at the alignment of the levees will serve to show how irregular and variable the confining banks are built, so that the bed of the stream is converted into a series of pools or lakes with narrow gorges, causing low velocities and large deposits in the stream bed at high water and increased caving of banks, which supply still more material to the bed.

"If the flood waters be thus regulated the river will soon construct a relatively permanent channel and maintain it at a reasonable cost, but it involves a radical change of policy, and the improvements should be carried on as rapidly as possible, with the co-operation of all the States directly interested."

The following extracts from "The Riparian Lands of the Mississippi River," by F. H. Tompkins, will serve to illustrate the present physical conditions resulting from the attempt to restrict the flow to this irregular channel:

"Physical Characteristics of the Mississippi River from the Ohio to the Red River, 750 Miles.

"The bed of the stream is through deposits which it has built up and torn down repeatedly. * * * The caving in the middle third of this portion of the river reaches enormous proportions. A large percentage of the alluvial banks throughout the reach yield readily to the eroding power of the current, and this erosion amounts to an average of about nine acres per annum for each mile of river. In places the river becomes excessively wide by encroaching on first one bank and then another; * * * again it becomes exceedingly crooked by the continued erosion of the concave bank.

"The width of the river reaches a maximum in this reach, the high-water banks being sometimes two miles apart. The banks are 30 to 45 feet in height above low water. Overflows are frequent, except where floods are restrained by levees. The sandbars are very large in extent, and wooded islands and towheads are numerous.

"The extreme range in stage from low to high water is about 53 feet, and the discharge varies from 65,000 cubic feet per second at low water to 2,000,000 cubic feet per second at high water (1:30).

"The destructive floods enter the alluvial basin at the upper end of this reach and sweep its entire length, gathering strength as they go, and often remain at an overflow stage for a period of nearly three months.

"The elevation of the upper end of the reach at low water is about 270 feet, and at the lower end the elevation is about two feet above sea."

This reach is, therefore, characterized by great variation in width, height and volume of discharge, "enormous" caving, long periods of saturation of levees, insufficient depths on crossings, being limited to five feet, and frequent overflows and crevasses.

As the levee system is extended an augmented volume of water is confined to the contracted area, thus increasing the variations of stage and discharge between high and low water and building up the crossing bars. Moreover, the general alignment of the levees as built is such as to cause still greater fluctuations of flow because of the variation in width, ranging from about two to over twenty miles, and creating a succession of lakes and gorges. The angular trace also opposes greater resistance to the

lischarge by reason of the salients and re-entrants, which also add to the length and ost of the works and increase the caving. In numerous places the construction of a ew miles would save from two to three times the length and give a much better flow.

But aside from their commercial and economic considerations, these questions have a far-reaching, humane value.

Devastations are inflicted on the poverty-stricken peoples of China by the Yellow iver, from the breaches in their levees and the flooding of the farms. Extensive suf-ering also exists in the steppes of Russia, where about 20,000,000 souls are reported to e starving by inches for lack of food, which cannot be transported from our overflow-ng granaries of the Northwest because of the engorged condition of the railroads and he absence of navigation in our rivers at the time when the crops should be moved.

In a country "whose stones are iron, and out of whose hills one may dig brass," it should be possible to distribute of our abundance for the general good, but the system s so seriously handicapped by the requirements of general legislation and national appropriations, which are far too limited and unproductive of useful results, that it is hoped the commission recently appointed by the President may evolve some practical and expeditious method of encouraging the improvements of our internal channels as aids to all classes of improvements.

In a recent issue of the *Marine Review* the leading article commends the President for his recognition, as the National Executive, of the importance of at last taking up his vital subject, and calls attention to some of the glaring defects which it is hoped the commission may see its way to remedy. It follows closely the argument which has been published in this series of the MANUFACTURERS' RECORD as to the need of a restoration of State sovereignty and jurisdiction over those streams and waterways which lie wholly within the confines of the States and recommends the more liberal application of the funds derived from the public treasury to the most important trunk lines, such as the Mississippi and Ohio rivers, and some of the principal harbors. It states specifically that "the method of carrying on this work also deserves the atten-tion of the commission. * * * Thus far river and harbor improvements have been costly, and it is believed unwarrantedly so. Lack of system, lack of interest, lack of appreciation of the work, have tended to make them almost a failure. This commis-sion should put the river and harbor improvements on a business basis."

Thus the old defects recur from time to time, but they can only be removed by action of Congress, and the effort to adopt a rational system of public works upon a permanent business basis, with a fixed and responsible personnel, properly selected from the best men the country affords, was tried back in 1888, but the idea of surren-dering control of the patronage accompanying the dispersion of funds from the National Treasury in the various elective districts was not looked upon with favor, and the desultory improvements continue as at present. It has even gone so far that in cases where local improvements have been desired for more than a generation, and which have been condemned as being unworthy of national appropriations because of the absence of enough tonnage, the Government is unwilling to permit improvements to be made by such localities at their own cost, with the right to charge tolls for the main-tenance of the works.

A recent report on the dangers and needs of a harbor of refuge on the coast of New Jersey, made by the State Geologist, recites that:

"Although from Sandy Hook to the Delaware Breakwater it is but 134 miles, rec-ords of the United States Life Saving Service show more disasters on this coast than on any other of equal extent in the United States. During a single decade 332 strand-ings occurred, more than one-half of them within the range of the Absecon light at

Atlantic City. During the year 1903-1904 nearly $2,000,000 of property were placed in jeopardy, but, thanks to the efficiency of the Life Saving Service, the actual loss was less than $75,000. This danger is greatly increased by the absence of any harbors of refuge along the coast. * * * The channels of the inlets are constantly changing in depth and location through certain cycles, and the inlets themselves are slowly shifting their position. * * * Owing to the enormous demands made upon the National Treasury for river and harbor improvements—demands which cannot be fully met for years to come—there is small chance of obtaining national aid for improvements along our coast, since the tonnage is restricted by bars. To a certain extent Congress has established the policy of permitting local interests to undertake improvements of a local character, but the way is so hedged about with restrictions that little can be done. There is need for further legislation by Congress, giving more power to State and municipal governments to initiate and carry forward improvements in navigable waters, particularly in those cases which have been reported as not of sufficient importance to warrant national improvement. * * * As the case now stands, the Government engineers have reported adversely for Government aid, and yet local authorities are not free to undertake the work themselves, even in isolated positions, without Government approval of plans. Under these circumstances there is much justice in the demands that Congress confer upon localities the right to carry forward these improvements in navigable waters, which have been denied national aid, according to local plans and without regard to the approval or disapproval of the War Department. The policy which refuses Government aid and forbids local endeavor, except under conditions which are prohibitive, as applied to New Jersey, has abandoned the inlets and bays of our coast to the vagaries of the waves and currents and will make their improvement under existing conditions forever impossible. Congress should enact legislation permitting localities to make their own improvements at their own expense and according to their own plans, and to charge tolls thereon. Such a policy would accord with that under which the enormous railroad systems and most of the waterways were originally built by private capital as commercial enterprises."

The present policy of limiting national appropriations to those larger and more important harbors or rivers where there is sufficient tonnage to justify such expenditures is forever to relegate the minor tributaries to a state of nature so long as the General Government assumes jurisdiction and does not permit localities to improve on a commercial basis by collecting revenues, as was done for many years under the power of the Constitution, and which right is still in vogue by all of the overland carriers exercising the rights of eminent domain, and collecting enormous sums of money to maintain and improve the service which the people so willingly accord and enjoy.

The fiction of "free waterways," under Government control, has done more than any other idea to restrict the improvement of the cheapest avenues of domestic trade and to bring about the congestion of the railroads from which the country is now so seriously suffering. It has led to the dissipation of large sums of money, as has been shown in the exhibit in No. IV of this series, with little actual relief, since the improvements thus made are isolated from the main avenues of commerce.

The truth of the assertion that Government methods need revision may readily be proven by the fact that its first plan for the opening of Southwest Pass, estimated to cost $13,000,000, with $390,000 per annum for maintenance, was hastily brushed aside because of a competitive plan to guarantee a 40-foot channel for $6,000,000 and a modification of the Government plan was adopted estimated at this latter figure, which provided for the securing of the channel by dredging at the ruinously low figure of four cents per cubic yard. The sequel shows that the dredges are not able to remove the

ud as fast as the jetties catch it, and the pass shoals up more rapidly than before, hile the competitive plan is suppressed.

VIII

In its progress from the forest, farm, mine or mill to the market or consumer every n of freight must traverse one or more of the three media—roads, railroads or rivers. luids may be made to transport themselves by gravity through pipes or other conduits, it there is a distinct relation existing between these several avenues of trade which s evidently not been fully understood nor appreciated by those most deeply interested the conduct of transportation as a business, and which for many years has served retard the best interests of the public.

This paradoxical condition has arisen from the belief that a competing water route, pable of transporting freight at lower cost, was a dangerous competitor, to be exter- inated at whatever cost, so that the canal and waterway have been made the object a war of extermination and elaborate arguments have been published by technical urnals claiming that the railroads could deliver freight more expeditiously and eaply than the waterway.

The functions of the carrier are to deliver freight by the line of least resistance, ne and cost considered, and if the path of any commodity be traced it will in general found to have been transported over the common road to the railroad, thence to the ill or factory, thence again to the warehouse or market and thence to the consumer home or abroad, so that the cost of movement on all of the media constituting the ay will enter into the final charge, in addition to many other factors. It may not be rne by any one alone, as they are mutually dependent. If the haul by wagon over eep and poorly-surfaced roads is long, the cost per unit may exceed 25 cents per ton- ile and there may be nothing left for the extension of the movement, whereas if, on e other hand, the initial or final movement be by water at a rate of a fraction of a ill, the margin for extending the market range will be greatly increased and the value the product, as well as of the source from which it was obtained, will be largely igmented. It is likewise manifest that if water can be substituted for rail or road, en at the expense of one or more transshipments, it may be found more advantageous. ipers are not slow to take advantage of the *rate* rather than the *time*, so that goods e frequently sent from the factory to the nearest seaport, and thence by a circuitous ater route, with several transshipments, to avoid a long overland haul: in fact, goods ve been sent from England to New York and back to London for less cost than the arge across country, so low were the ocean rates at the time. Thus a consignment of ttery was intended to have been shipped in two parts from Tunstall to London, 148 iles, but through an error of the clerk one crate was forwarded to New York and ence back to London by water at a cost of only 15 shillings per ton for the entire 50 miles, while the charge on the other overland shipment was 25 shillings per ton.

In this connection, and as an illustration of the wisdom of the policy which has ilt up one of the greatest railroad organizations of the world, it may be expedient to troduce a few extracts from a personal communication to the president of the Penn- lvania Railroad by its general superintendent, dated November 17, 1853. It is ldressed to J. Edgar Thompson, president, and reads as follows:*

Railroad Policy Outlined.

"Dear Sir: * * * I consider that the great objects of the construction of the ennsylvania Railroad were to build up the city of Philadelphia, to promote the

*This letter was found among the effects of Herman Haupt, chief engineer Pennsylvania ailroad.

increase of trade and the general prosperity of the State, and at the same time to pay fair dividends to the stockholders.

"I consider from 8 to 10 per cent. a fair dividend, and this may be earned either by a small business at high rates or by a large business at low rates. If the company should refuse to carry a pound of ordinary freight and confine their business to passengers and express, I believe that dividends of 8 per cent. could be paid, but such a policy would be injurious in the extreme to the commercial interests of Philadelphia, which require that every possible facility should be afforded to trade and every effort made to bring upon the road the largest business it can accommodate. To secure these advantages a system of low charges upon articles of great weight and little relative value is indispensable. In a word, the motto of the company should be *a large business, low rate and fair dividends.* But until the road is double-tracked the low rates must be limited to articles carried for "back-loading" or at the convenience of the company.

"When a road is in condition to accommodate an increased tonnage the profits resulting from it must not be estimated by charging this business with an average of the expenses, but only with the increase consequent upon its carriage. * * * [Here follow statistics to illustrate.] * * * From these results I am led to conclude that this company, with a double-track road, under one management, could transport coal at a cost of about one-half cent per ton-mile without actual loss, and lumber at nine mills per 1000 feet, and that a charge of one cent per ton per mile on an increased business of 500,000 tons carried 200 miles would pay a net profit of 5 per cent. on $10,000,000, furnishing a most desirable increase to the revenues of the road if we were in position to accommodate it, which, of course, we shall never be while that incubus, the State tax, continues.

"But even if this business did not pay a dollar of revenue, my opinion is that it would be to the interest of all parties that it should be accommodated, as it would give employment to a large population and stimulate many other important interests. * * * It should be observed that even if low rates be permanently fixed upon coal and lumber it would be a year or more before the stimulus of this reduction could lead to a sufficient increase to embarrass our transportation, by which time we could be prepared for it.

"Under the influence of such opinions, I have encouraged those who have consulted me to invest capital in coal and lumber operations and to make extensive improvements. So clear to me did the true policy and interests of the company appear that I could not suppose it possible that a different view would be taken by those who would have the management of the traffic. The existing policy is calculated to reduce the business within very narrow limits.

"This letter has been written not as an officer of the company, but as an individual. I have, as you know, no connection in any way with transportation or regulation of tolls, and therefore could see no impropriety in defining my position and in giving expression to my opinion." * * * Thus more than 50 years ago the analysis of the traffic for the first year after the opening of this great railway through to Pittsburg showed that it was one of enormous possibilities under the policy as then outlined, although the management was not convinced at the time of its expediency. The tonnage then did not exceed 160,000 tons, and the average haul 170 miles. The ton-mile rate was about 5.7 cents, as compared with about 5.5 mills in 1905, when the traffic east of Pittsburg and Buffalo was 156,533,351 tons, or nearly 1000 times greater.

In the light of the actual facts it is worthy of note that in 1853 the chief engineer presented an urgent plea to the directors for the acceptance of this policy of low rates, predicting that in a short time it would develop a traffic of 1,000,000 tons, which is

vould require 300 freight engines, costing $2,500,000, to transport, and that the net arnings of the road would be greatly increased thereby. It was not, however, until ome years later that the accuracy of these predictions were realized, as they were emonstrated by experience, and the low-rate policy became fully adopted.

The Eastern division, extending from Harrisburg to Hollidaysburg, at the foot of he Portage Railroad, was 136.7 miles long, and the Western division, from Johnstown o Pittsburg, 78 miles; total, 214.7. They were built at an average cost of $33,000 er mile, while the Mountain division was estimated to cost $60,000 per mile, exclusive f equipment. The estimated cost of the whole road with a double track was $13,665,-00. (See Annual Reports for 1852-53.)

Railroad Regulation.

From these incipient stages the railroads have grown into the greatest single indus-ry in the country, which, by a process of elimination and concentration, has acquired o great wealth and power as to have almost passed the safety limit between servant nd master.

The vital question is no longer one of traffic, wherewith to meet operating expenses, or the roads are engorged with tonnage which cannot be promptly handled; but for apital with which to provide additional tracks, terminals and storage, if they may be ad at any price, and to this end it must be shown that this class of investment is at east as safe and profitable as any other, so that the additional loans required for bet-erments may be readily sold in open market without being baited with watered stock. This result cannot be secured by additional legislation, of which there would seem to e a plethora already, except so far as it may be required to check the discriminations, ebates, special privileges and parasites which prey upon the revenues derived from ncome, and to this extent serve to aid the management as well as to secure greater rotection for investors in railroad securities. The average dividends paid on the ntire capital of the roads of the United States, being only about 3 per cent., are not n themselves sufficient to tempt investment, even in bonds, much less in the stock of uch corporations.

As previously stated, no general legislation can be framed which will meet the ever-arying conditions of railroad traffic in this broad country, where every road must have ufficient latitude to regulate its own details according to local conditions and environ-nents, but the best that can be done is to place reasonable checks upon the various orms of evil which have to a large extent impaired confidence in the wisdom, if not in he integrity, of the management and enabled the officials of large properties to acquire normous fortunes by the manipulations of their securities, which under other circum-tances would have gone to the public or to the security-holders.

But the best regulators of rates and producers of income are the waterways which arallel the railroads, and the deeper and larger they are made the better. Yet these arge channels permit the construction of larger vessels, with still cheaper tariffs, which would appear to militate against the overland rates, but which, in fact, merely elieve the railroads of the basic raw materials required by the industrial centers, thus giving to manufacturers a greater margin for the extension of their margins for their products and enabling the railroads to increase their revenues from the higher class of freights.

This law has been so oft repeated of late years that it seems trite to even mention t here, but a single illustration may serve a purpose.

Benefits of the Manchester Canal.

The Manchester district of England was so crippled by the gradual extinction of the early canals and the high rates imposed by the railroads, as well as by the port charges at Liverpool, some 35 miles distant, that the district concluded to open a 26-foot canal to the Mersey and thus connect with the sea. This project was bitterly opposed by the existing vested interests, both in and out of Parliament, but the energy of the projectors and the continued distress of the district finally prevailed, and the canal was built at a cost of about $75,000,000 and opened for traffic in 1894. Anticipating this, the railways had discounted the trade by making long-time contracts at low rates, so that the indirect benefits became at once manifest, and the 13,000 empty mills and dwellings began to fill up, and within the 10 years following not only were they all reopened, but as many more were built, while the docks and terminals were enlarged and the canal itself deepened two feet at an additional charge of about $10,000,000. In 1903 the net revenue was nearly $1,000,000. The indirect benefits of these improvements are far-reaching and impressive, extending to the five lines of railway and the port of Liverpool, as well as to the entire district, covering a population of nearly one-fourth of the kingdom. All of these changes are directly attributable to the enterprise of the corporation of Manchester and vicinity in financing this great work and pushing it to a successful issue against the most vigorous opposition and many physical difficulties and reverses.

The indirect benefits become at once apparent by noting the saving in the cost of the following items, amongst others, effected by the canal: The saving by the canal on one ton of cotton was $1.66; on sugar it was $2.81; on tea, $2.40; on bacon, $2.10; on canned meats, $2.35; on wheat, $1.77; on petroleum, $2.12; on tallow, $1.91; on timber, $1.16; on wool, $2.16; on iron ores, $1.02—giving an average on these low-grade staples of about $2 per ton. Applying this saving to the present tonnage of the canal, it would represent an indirect economy to the people of the district of over $10,000,000, or more than 13 per cent. on the $75,000,000 of cost, thus fully justifying the enterprise, regardless of the returns from freight and the great improvement in the general business of the railroads and the entire district, including the rival port of Liverpool.

Canals Under Control of Railroads in Great Britain.

The effect upon the traffic and returns of canals under management of railroad corporations in general may be seen from the returns of the Board of Trade of Great Britain, which stated that in 1898 there were 2768 miles of independent canals, having a traffic thereon of 33,348,573 tons per annum, producing a net revenue of $1080, and, per contra, there were 1138 miles of canals under railway control, having a traffic of 6,009,820 tons per annum, yielding a net return of only $200 per mile, from which it appears that the independent canals carried 12,048 tons per mile, as compared with 5281 under railroad management, and that the returns by the former were 5.4 times greater per mile than by the latter, so that the public received a much larger service and the security-holders a greater net return from the canals under independent control than from those held under the rail management.

In the United States.

The same conditions appear to exist in this country where the two kinds of transportation are under one management, as is clearly shown in the case of the Camden & Amboy Railroad and the Delaware and Raritan Canal of New Jersey, consolidated by what was known as the "Marriage Act" of February 15, 1831, requiring both the railroad and canal to be built simultaneously and to be operated by the same board of

directors. In 1832, the first year in which the railroad was opened, the passenger business was about 52,000, and the comparative traffic of the competing routes under the same management was as follows:

Years.	Freight on rail. Tons.	Freight on canal. Tons.	Passengers on rail.
1835	6,875	57,736	147,424
1840	11,325	172,120	153,112
1850	42,242	568,403	345,425
1860	183,750	1,639,998	479,330

From which it appears that the canal tonnage exceeded that of the railroad by from 8 to 15 times its weight, and it continued to increase until 1866, when it reached its maximum of nearly 3,000,000 tons. In 1868 the canal transported 2,519,285, and the next year 2,547,212, but on the 30th of June, 1871, it was leased to the Pennsylvania Railroad Co. for 999 years, with its interest guaranteed at 10 per cent., and immediately the traffic began to fall, so that today it is far from paying operating expenses, although it earned over 20 per cent. net prior to the lease. It is thus indefinitely tied up as an element in interstate commerce.

In this connection it may be well to observe that in a prior lease made as early as 1837 it was proposed to prohibit the carrying of passengers or baggage on the canal, but this lease never went into effect. Later, when in the 50s the National Government contemplated the building of a national military railway across New Jersey, the directors petitioned the State not to permit "such an encroachment upon her sovereignty and the destruction of an important pecuniary interest, as no such necessity existed." This protest was renewed two years later, or just prior to the Civil War, when the importance of the coastwise waterway was so forcibly demonstrated by the use made of the Chesapeake and Delaware Canal in forwarding troops and stores to protect the capital. These canals still remain in the same condition as then, so far as capacity is concerned, for the Government has done nothing to relieve them from tolls nor to enlarge them for commercial or strategic purposes. Thus this most populous section of the interior coastwise canals and rivers remains throttled by the lack of enabling legislation which has been pending for nearly 40 years, as has been so well set forth in the timely and forceful paper of Representative J. H. Small of North Carolina in the MANUFACTURERS' RECORD of March 21 last.

Another instance of the paralyzing influence of hostile control is to be found in the experience of the Schuylkill navigation, opened in 1825 from the anthracite coal regions to Philadelphia, a distance of 108 miles, for bateaux of 25 tons. It was enlarged to pass boats of 80 tons in 1832, and was doing such a prosperous business that its securities were quoted at 3½ times their face value. The competition with the Reading Railroad began in 1842, and soon became so desperate as to require an enlargement of the waterway for boats of 170 tons and the reduction of the number of locks from 120 to 71, involving heavy expenditures, which were made in 1846-47. These were followed by a disastrous flood in 1850, which destroyed a part of the works and placed the company in an embarrassed condition, forcing it to liquidate in 1852, when its debts were $10,260,000. The new company continued the struggle against the cut rates of the railroad, but the canal finally capitulated and the railroad secured control of the works by leasng them for 999 years at an annual rental of $665,000, after which the tolls were increased about $1 per ton. This lease went into effect in 1870. and the tonnage began to dwindle away from the water. In 1880 it was 706,000; in 1890, 182,992, and in 1900 about 58,000 tons. The receipts had fallen from $573,133 in 1880 to $102,012 in 1900, or far below the guaranteed interest, which would entail a loss on the company unless the additional charge over and above the rail haul were collected from the public to cover the extra cost of transportation and this interest on the

shares, which were purchased chiefly by the railroad company. As the works must be maintained by the lessee, it would seem that neither the railroad nor the public are benefited by this contract. It is believed this condition could be modified to advantage.

IX

This series of articles was prepared at the instance of the progressive and enterprising MANUFACTURERS' RECORD, whose broad horizon discerned so clearly the trend of events and the fact that transportation is rapidly reaching a limit beyond which the existing system of railroad carriage cannot meet the demands of the present moment.

This has given rise to the grave problem of providing an immediate and practicable remedy, that there may be no diminution in the ratio of progress of this great nation, and to this end it has become necessary to take a retrospective view of the evolution of the several systems, which have, in turn, led to the exisiting condition, touching upon the mutually dependent factors of legislation, finances, management, control, traffic, cost, results, capacity, safety, dispatch and other items which are inseparable from so important a service.

In summing up the argument it may seem best to present a brief resume of the facts and history cited, that the basis for the conclusions reached may be more forcibly impressed upon the citizens of those sections of the Federal Domain who are in great need of relief and who have been hoping against hope, it may be for a generation, that a paternal government may be able to provide it in the near future from the public treasury.

But the sequel shows that, under the present policy of allotting appropriations, the demands for war, navy and pensions are so enormous as to leave but a mere pittance for the fundamental departments of agriculture, mining, commerce and transportation, most of which are relegated to the individuals or corporations engaged therein, and under which policy they have made most astounding progress.

The single exception to this mode of procedure is in the development of that portion of our domestic commerce which is conveyed by water. After the Civil War the Government increased the duties of the military arm of the service by assigning the officers of the corps of engineers to civil duties, in addition to their military occupations, placing them on detached service in charge of river and harbor improvements, and building up a bureau which has rendered it practically impossible for any section or locality to make improvements at its own cost or risk as before, when the country possessed more than 5000 miles of such cheap and free avenues of trade, while today, notwithstanding the enormous expansion in population and tonnage, the canal mileage is reduced more than 50 per cent.

Another important factor in preventing the appropriation of public moneys for minor river projects arises from the greater economy of conducting transportation in larger vessels, so that the rapid increase in the draught of the ship has necessitated much deeper and wider channels, especially at the great ports on the Gulf and the Atlantic seaboard, thus concentrating the expenditures at those commercial centers, and as the steering committees of the dominant party limited the allotment to the niggardly sum of about $20,000,000 annually, it fell far short of the urgent demands of even the most imperative works, and the minor projects were not even permitted to be undertaken by their localities upon a commercial basis at their own expense. Because of the absence of tonnage due to the obstructions imposed by nature, the Government reported the

calities "unworthy of improvement," but did not release them from its exclusive jurisdiction. Such a policy operates as a barrier rather than as an aid to domestic commerce, and diverts traffic to the railroads already surfeited with freight, imposes an unjust tax upon non-competitive communities and checks the normal growth of the States and of the nation.

In a recent forceful address before the Western Society of Engineers at Chicago Hon. Jos. E. Ransdell, president of the National Waterways Congress, submitted a most cogent argument in behalf of a more liberal policy of improvement, in the course of which he frankly stated in a direct personal appeal to Chas. T. Harvey, civil engineer, who built the greatest locks in the world in 1855 at the Sault Ste. Marie:

"Since you built that lock at 'the Soo' see the truly wonderful development in all modes of transportation on the lakes in the last 25 years. Can one of you point me to a single improvement in river transportation in that time?" He closed by an appeal to the civil engineers "to help build up the navigation on our rivers. It pays to encourage it, and you should help it along."

It may be well to note that this class of improvement has passed beyond the control of the graduates of our technical schools, and that they can only be interested as employes, whose duty it is to make surveys and report facts, but not to control works or assume any responsibility for results. The last recourse of those in charge is to the temporary relief secured by dredging, without regulating works in many cases, and as a consequence greater cost for maintenance and no permanent reliable channels. Features of this series of articles were as follows:

I.

1. In the opening article stress was laid upon the necessity for enabling legislation authorizing a return to the original policy of developing waterways as commercial highways by corporations under State charters, not only as media for the cheap transfer of freight, especially of raw materials or bulky products, but also as regulators of rail rates by national means, which operates beneficially and not injuriously upon the alleged competing railroads.

2. It was shown that the revenues of the railways in Pennsylvania, where the canals are almost exterminated, are $6,500,000 less than in the State of New York, because of the existence there of canals, and to maintain which that State is now expending $101,000,000 to increase the capacity to 1500 to 2000-ton barges by making the depth 14 feet and the locks 328x45x14 feet in size.

3. In the colonial days roads and rivers were the only means of communication, and the Constitution of 1787 made no provision for conducting transportation by rail or trolley, pipe lines or pneumatic tubes, as such resources were unknown, but it merely provided for the regulation of commerce between the several States with foreign countries, to prevent rate-cutting and establish uniformity, and later to protect the waterways from obstruction by bridges.

4. The improvements of rivers and harbors were under the jurisdiction and control of States authorized to charter local corporations, which has been the policy pursued in the construction of turnpikes and railroads to this date, and in consequence of which private capital was freely invested in canal and river transportation.

5. Since the assumption of these functions by the National Government more than $500,000,000 have been expended from the public treasury, which has given rise to much public criticism as to its application and lack of results, while the local initiative has in most instances been nullified and the works upon lateral and tributary streams almost wholly arrested.

6. The urgent demands for immediate relief will require more than $400,000,00 and take many years before they can be made available, yet there is no department c Government works where the door is so closely barred against competition, and wher so many large industries and interests are so seriously restricted because of lack o transportation facilities.

7. The most practical relief can be secured by a return to the antebellum polic of State and local control, so imperatively demanded by commercial and trade bodie under a rational policy of public civil works.

II.

1. The second paper lays some stress upon the factors which have entered into th growth of the railroads and which have ultimately produced the existing congestio due to the lack of adequate terminal facilities and plant to handle the enormous traffi carried in small units. In consequence, the efficiency of this system is not even keepin pace with the increase in population, whilst the tonnage is growing five times as fast

2. It is shown that the last appropriation act for national river and harbor works which is the largest ever passed, is applied chiefly to the deepening of a few principa harbors, in the effort to keep pace with the growth of the vessel, and to the protection o the Mississippi and tributary basin from inundations, while only about $5,000,000 ar for new projects, and many which have been before Congress for from 25 to 40 year receive no aid and are still not released from Government control in such manner as to be undertaken by the localities directly interested. Projects urgently recommended by Congress more than 30 years ago still remain buried on the pages of the archives of that august body, while legislation is pending attempting to reduce rates on certain classes of rail traffic, which merely increases the rate on other items on the schedule or changes the classification, and may still further impair the capital by reducing the interest and dividends of the roads.

3. In foreign countries, where waterways are well developed, the railways are enabled to segregate their traffic and to charge much higher rates in consequence, while the people are better served with the bulky freights at lower rates, manufacturing plants are distributed more generally in rural districts or where water-powers are available and the railways are benefited.

4. More than half of the traffic carried consists of the products of the mines, which, with those of forest and agriculture, constitute 75 per cent. of the movement, and all of these having a relatively low value will not bear a long haul; in fact, the average in the United States being but 130 miles, the greater volume must be moved over a lesser distance in the most populous districts, so that the length of haul overland must be short, while for world-wide or export commerce it must be long and would be impracticable but for the much cheaper water rate.

5. The enormous coal reserves of the West cannot be fully used because of the prohibitive cost of rail transportation to the seaboard, while the deposits of the Gulf States are still latent awaiting the opening of the rivers and canals in Georgia and Alabama.

6. There is apparently too much legislation in the direction of restrictions to the development of rail and water routes by the effort to regulate rates or impose taxes on public utilities, thus constituting the companies agencies for the indirect collection of taxes for the expenses of governments, which must be added to the charges for service. During 1905 over $63,000,000 were collected as taxes on railroads, which their patrons necessarily paid.

III.

1. A few instances are given of the great earning capacity of canals, even of limited dimensions, under fair conditions, some of them even exceeding 100 per cent. per annum. The Erie Canal has proven to be one of the most profitable investments the State of New York could have made, both directly and indirectly. Tolls were abolished in 1882, yet the canal not only "presents itself to the State" free of all encumbrances, but gives a bonus of $27,000,000 net profit. "*Five-sixths* of the gross income were net gain," and the railroads have invaded this "low-grade" populous territory to reap some of the fruits which have been mutually beneficial, so that the efforts on the part of certain interests to prevent the enlargement of the canal were defeated by aid of the railroad interests.

2. The National Government has likewise been richly repaid by its purchase of the Sault Ste. Marie, the Louisville and Portland and other canals and the Monongahela Navigation Co., all of which were rapidly and well built as commercial enterprises by corporations and finally acquired by the nation in behalf of the public. The improvements on the Great Lakes, which have cost the Government some $70,000,000 only since their early inception, have effected an economy in the traffic of the single year 1906 amounting to over $300,000,000.

3. The Illinois and Michigan Canal, opened in 1848, has saved to the people of Illinois $180,000,000, and the State is now urging the right to enlarge it from Chicago to St. Louis at its own expense.

IV.

1. It was the early policy of the General Government to aid the States and corporations by loans or purchases of stock or bonds, but of late it is expected that localities should contribute the right of way and also appropriate large sums to local works under control of the nation.

2. The decline in rates of transportation, due to improvements in plant and equipment, is shown, yet the size of the old canals has in many cases remained unaltered, while the boats have outgrown their capacity, so that the canals have thus been thrown out of service, not because they are not the most useful handmaidens of industry, but because of their lack of capacity. Thus in 1872, of the traffic carried between the populous centers of New York and Philadelphia, only one-sixth was borne by rail, and from Philadelphia to Baltimore the proportion was less than one-third; in other words, 85 and 77 per cent. was carried by water, respectively.

3. The commercial paradox is explained as to why the cheapest possible water carriage is found to be beneficial to railroads everywhere, and the expenditures made by the Government each decade is given, showing its rapid increase in magnitude. with the remarkable result that the tonnage on the rivers has not kept pace with it, for the reasons already given, viz., lack of adequate channel dimensions.

4. A plea for local initiative and control as a means of removing the obstacles to the enlargement of our commercial routes for the relief of the existing railroad engorgement, which under present conditions must become far more serious.

V.

1. The drift of the center of population 500 miles westward during the century has increased the average haul for export commerce and changed the *locus* of the line of least resistance to the seaboard in favor of the Gulf ports of Galveston, New Orleans, Mobile, Fernandina, Tampa, and to the South Atlantic ports of Brunswick, Savannah and Charleston, Norfolk and Newport News.

2. The greater need of an early improvement of the outlets of the Great Basin at

low stages and a brief description of the efforts to improve the Mississippi (a) by canalization, (b) by revetments, (c) by reclamation, (d) by dredging, to little purpose.

3. The average value of farm products in the interior as affected by the cost of transportation to the seaboard by rail or by water, showing that the farmer must pay this bill, thus reducing his profit as well as the value of his property. The lowest value zones are those most inaccessible by water.

4. A brief description of the "Great Belt Waterway," with its links across the lake divide, connecting those great inland seas with the tributaries of the Mississippi and Ohio basins by the antiquated canals of the last century, and the awakening as to the immediate necessity for their enlargement, especially from Lake Michigan to the Illinois and from Lake Erie to the Ohio through the congested iron and coal districts.

VI.

1. Refers to the premature efforts of the civil engineers to effect a reorganization of the public works of this country in 1888, when the committees of both houses of Congress reported the Cullom-Breckenridge bill, which was defeated, and which calls attention to some of the defects then manifest as set forth in the memorial, which have not been removed by time.

2. Shows the effect of rates upon the market range of different commodities and the great importance of the lesser rate to extend the area of distribution.

3. Discusses still further the possibilities of the southern outlet via the Mississippi and the effect the levees have had upon the low-water channel, with the comments of the press as to the need of continuing the struggle with the river.

4. The importance of opening the outlets at the delta to relieve the stream of its mud as well as to reclaim arable lands and prevent floods is briefly described.

VII.

1. In this number the views of a railroad magnate having large mileage centering at the port of New York are stated as in favor of the levees for the Mississippi, since they would not improve the navigation at low water and hence not divert traffic from his lines.

2. Queries from members of Congress as to the best method of handling this great problem sent to civil engineers, calling for voluntary opinions that if possible some efficient remedial methods might be available, and answers thereto calling attention to physical laws and conditions which must be applied if any permanent relief is to be expected.

3. The experience in the older dynasties of the globe in treating similar rivers, resulting in great devastation, famine and death by millions.

4. Collaboration of some public sentiments as to the need of modifications in the policy of conducting their works, the lack of system and the inadequate results, and urging a return to local control, with executive powers to construct works on a commercial basis, subject to condemnation and purchase after a reasonable time, when the traffic may have been developed.

VIII.

1. Calls attention to the mutually dependent systems of roads, canals and railways and the enormous sums paid by the people annually for transportation, amounting to not less than $3,000,000,000.

2. The early policy of the Pennsylvania Railroad traffic as outlined in 1853, when the tonnage did not exceed 160,000 tons and the average haul 170 miles, advocating a half-cent rate per ton-mile on coal, etc. Today it is over 160,000,000 tons east of Buffalo and Pittsburg, and the rate a small fraction under five mills.

3. The enormous growth of the railroad interest and how the development of a reat ship canal may transform a region from a condition of decay into one of great ctivity and abundant prosperity.

4. The influence of railroad control upon the canals of a country is prejudicial to ıe interests of the people as well as to the railroads, as the deficit must be paid by the dditional charges by rail to cover wear and tear.

5. The leasing of waterways for periods of 999 years is pernicious, and should be epealed in the interest of all parties as speedily as practicable and the waterway out-ts from the coal region been fully restored.

In brief, the railways have reached their limit without incurring enormous expendi-ıres for extensive improvements, which the rate of interest paid their investors, the ifficulty of making loans, the scarcity of materials and labor and the higher prices of ll commodities render well-nigh impracticable.

The alternative fortunately remains, however, to divide the freight traffic in many ıses by restoring it to the existing canals, which may still remain under the control of ıe railroads and which must be maintained under the terms of their leases, and of ebuilding and enlarging others long since defunct, so that the bulk of the coal, ore and ımber tonnage may be carried by water and the short haul between the mine and ınal be substituted for the much longer one from mine to consumer.

But most of all is it necessary that personal initiative and local construction and ontrol be encouraged without embarrassing conditions, accompanied by the right to harge tolls for a reasonable period, with the possibility of purchase by the State r nation for public use as a free waterway.

The condition of the works now approved by the Government, the impossibility of ecuring sufficient allotments from the public treasury, the much greater cost of con-ucting these works under the eight-hour law than by private contracts, the frequent hanges of administration officials and modifications of plans all militate against the robability of securing early relief from national sources.

The South, with its munificent resources, equable climate and excellent railway acilities, should be able to secure capital from those foreign countries having well-eveloped systems of waterways, where the value of such economies, as well as of ample ater-powers, are fully appreciated, and where the people are frugal and industrious. ountries like France, Belgium or Holland would no doubt be pleased to take State onds for such works if properly presented and approved by their agents and engineers. t all events, the crisis is upon the nation, and a simple, expeditious method of relief hould be provided as soon as practicable.

X

In the previous numbers attention has been directed to the physical conditions ttending the conduct of transportation upon existing or extinct routes, and it only emains to point out a few of the salient possibilities of this ever-present problem, hich should command the immediate attention of those enterprising and patriotic itizens who are ever on the alert for the development of their native land.

Although "the earth is the Lord's and the fullness thereof," He has given its care o man as his heritage, with authority to subdue it, and to this end has stored its gran-ries and mines with abundant resources which may be utilized for this purpose.

A mere knowledge of the existence of these deposits of wealth or of their extent oes not avail anything for the betterment of social conditions, but they must be made

accessible by the expenditure of energy, requiring time and money, to bring them into the market.

In the monograph just issued by the MANUFACTURERS' RECORD* the enormous productivity and resources of the South country are so graphically set forth as to excite the amazement of the rising generation, and yet its possibilities have been long known to a few of the earlier adventurers who explored that region in the years that have gone, and who have given to the world glowing descriptions of the great fertility of the mines, forests and fields of that sub-tropical region. Political and social conditions have kept it dormant for a long time, but now it is fast becoming the most accessible and attractive section for investment in the line of transportation facilities, which give value to the many rich products of the region lying between the 30th and 35th parallels of latitude and within ready reach, by natural streams, of the sea.

That wizard of statistics, Mr. Edward Atkinson, in an impressive contribution written for *The Forum* in 1892 on the subject of "Incalculable Room for Immigrants," pointed out the great possibilities of the South, where labor is so much in demand, in these memorable words:

"Again, it has often fallen to me to describe what I called 10 years ago a '*terra* almost *incognita*' of the United States, the 'Land of the Sky,' comprising Eastern Kentucky, Eastern Tennessee, Northern Alabama, the mountain country of Georgia and the Carolinas, and Southwest Virginia. I have said many times that a square could be laid out, including the Piedmont plateau on the east and the Cumberland plateau on the west, nearly as large as France, twice as large as Great Britain, possessing potential in agriculture equal to either, timber and minerals, especially iron, equal to both combined. This area has as yet only begun to be worked; it is just emerging from the danger of extravagant speculation so that it may become productive and habitable."

Twenty years earlier the great civil engineer, James Worrall, representing the waterways of the Keystone State, wrote to its Senator, Simon Cameron, urging the general development of the water routes of the country, and referred to the possibilities of those of the South in these words:

"As local works there can be no doubt of the success of the great Georgia and Alabama canals. The prospective production of that country is simply incalculable. So soon as the political asperities subside in those States and the people of our whole country can feel as thoroughly protected in person and property there as they do in the North and in the West, an access of industrial prosperity will be inaugurated in that region which even in the most active and stirring portions of the North and West will never have been exceeded. * * *

"Then the vast physical, material and economical advantages of those States will be availed of, and canals and railways will build themselves. The Coosa will be joined to the Tennessee and 'wild Altamaha' will cease to 'murmur in its woe.' * * * The coast also is admirably adapted for interior navigation, one of the safest and cheapest possible. A sloop navigation accommodating vessels of 9 or 10-foot draught extends now along the shore for hundreds of miles, requiring very little improvement to make it continuous from Norfolk to Florida. A canal across the Floridian peninsula would extend that navigation to the Gulf, when the outside navigation would be abandoned and its dangers avoided. These are things to be looked to in the contemplation of the prospective commerce of this great country."

Colonel Worrall was right, and his prophecy is rapidly being fulfilled, for the South is becoming the home of the iron and textile-manufacturing industries of the country,

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*"Facts About the South," by Richard H. Edmonds, editor, Baltimore, Md.

nd when, as has been shown, the value of the cotton crop far exceeded that of the nited gold and silver of the world last year, it may begin to be appreciated that the esources of that section are already such as to warrant the local construction of water- ays to conduct her tonnage to the seaboard. Yet as these works will necessarily con- titute a link in the shortest water route from the great Middle and Northwestern States, there is every reason why the General Government should also contribute largely o their early completion. It should be borne in mind, however, that the losses to a istrict and the retardation of its development, due to absence of communications, may ar exceed the cost of the construction of such works, and, in the light of recent state- ents from the learned chairman of the rivers and harbors committee of Congress, it ould appear that unless State and local initiative are inspired to undertake these very ecessary improvements another generation may elapse before they are even begun.

Mr. Burton said in 1901, and subsequently repeated, that "because of the enormous um of money required to complete existing projects under way and contemplated amounting to about $500,000,000), it is necessary to omit entirely or only partially rovide for a large number of improvements, many of which are no doubt deserving of arly attention. It is evident that the prosecution of many of these improvements must e postponed for a long time or they must be rejected altogether."

In this latter case it becomes necessary, under recent constructions of the Consti- ution, to secure special legislation, which may still further delay operations many ears. In a few instances such legislation has been granted lately to private parties, s in the case of the Cumberland River Improvement Co., which was authorized to mprove "that river above Burnside, Ky., by the construction of necessary locks and lams. The right is given to charge tolls. It is, however, provided that the franchise hall terminate 40 years after the completion of lock and dam No. 21, etc."

Again, nearly 40 years have passed since the importance of this connection between he waters of the interior basin and the South Atlantic were examined and reported pon as being entirely feasible and eminently desirable, but the demands for public funds elsewhere appears to have been even more imperative, and the works and their dependent industries are still only latent possibilities. As there is a large profit from such investment, both from the power plants and the traffic, there should be little diffi- culty in financing it under State charters and competent control.

In closing his report upon the survey of this route the engineer in charge submitted a brief comparison with others designed to connect the Mississippi with the Atlantic, in which he stated:

"Taking St. Louis as a starting point, the distance by this route to Brunswick, Ga., is 1508 miles by careful measurement, 265 miles of which consist of canal and slack- water navigation.

"From St. Louis to New York, by way of the Illinois and Michigan and Erie canals, is 1960 miles, and by way of the Portsmouth, Ohio and Erie canals it is 1813 miles. * * *

"The difference in distance in favor of the Brunswick route is 305 miles, about one- sixth of the whole distance, and the canalized portion is also much shorter, so that the time and cost are much less.

"Three transfers of cargo are also saved. * * * The total saving in cost by the Brunswick route is $1.81 per ton, or about five cents per bushel. * * * The arguments and reasons which may be advanced in favor of opening this route need scarcely be alluded to here. as they have been set forth by the commercial conventions which have been held in this country for years. This is quite sufficient to show that it is a real *necessity* which underlies this movement—a necessity born of the fact that

the enormous increase of population in the valleys of the Mississippi and its tributaries has caused the production of grain to far outstrip the means of its transport. The old routes by water and rail are crowded to their fullest capacity, and either new routes must be found or the results of the farmer's labors must remain uselessly on his hands. As the cost of transportation by rail is from five to six times as much as by river, and about three times as much as by canal, in looking for new routes the waterways are to be preferred.

"This route enjoys every advantage possessed by the others, and is superior to them all in this, that it will never be obstructed by ice; will never be rendered impassable by drought; does not descend sufficiently low into the heated region to have its cargoes injured by heat or moisture; will require no rehandling of cargo, and will cost but little more than the Erie Canal when enlarged, while its capacity will be greater, and it will, like the Erie Canal, pay for original outlay, interest, expenses of repair and service, with large balance to its credit in the course of 30 years."

The estimate accompanying this report for the entire distance from Cairo to Brunswick was very nearly $40,000,000, and the distance 1308 miles. It was designed for barges of 170 tons at low stages (three feet), and for 300 tons on a five-foot draught. The annual capacity of the canal alone is estimated at 13,867,200 tons. This is independent of the local freights on the rivers.

From Cairo, on the Mississippi, at the mouth of the Ohio; thence up the latter river to Paducah, at the mouth of the Tennessee, 50 miles; thence up the Tennessee river to Florence, at the foot of the Muscle Shoals, 255 miles, in the upper 30 miles of which the depths at low water are in places limited to from 12 to 20 inches. In the reach from Little Muscle Shoals to Brown's Ferry, 38.5 miles, the rise is 134 feet, and this section is only rendered navigable by a canal extending along its northern bank, now completed and in use by the local traffic. From Brown's Ferry the Tennessee is navigable for a distance of 200 miles, but the best connection between the Mississippi and Atlantic drainage leaves the river at the mouth of Short creek, two and one-half miles above Guntersville, or 75 above Brown's Ferry, and crosses the divide between the Tennessee and Will's creek, a tributary of the Coosa, which empties into Mobile bay, by canals, slackwater and river, across Sand mountain via Gadsden to the Coosa; thence up that river to Rome, Ga., at the junction of the Oostenaula and Etowah, a distance of 153.5 miles. On this section the rise from low water in the Tennessee to the summit of Sand mountain is 400 feet, and the fall to the Coosa 464, making a total lockage of 864 feet.

From Rome the line turns to the southeast and follows the course of the Etowah to the mouth of Owl creek, 53 miles, from which point a canal is proposed to Macon, at the head of flatboat navigation on the Ocmulgee river, a distance of 158¼ miles, crossing the valley of the Chattahoochee by an aqueduct 117 feet high and 375 feet long, and the divide by a tunnel 3200 feet in length. This canal will pass within a few miles of the city of Atlanta, and will develop a large local traffic.

From Macon, on the Ocmulgee, down that river to the Altamaha, and thence to the Atlantic coast, the distance is 500 miles, as given by the steamboat pilots. The depths are given as from two and one-half to four feet at low water, which lasts from three to four months. There are no rapids, and during the floods the river rises from 8 feet at Darien to 25 at Macon.

The estimates were made for a canal 70 feet wide at the surface and 5 feet deep, with locks of 135 feet length and 27 feet width, capable of passing boats 120x26½ feet, having a capacity of 300 tons on a five-foot draught.

The lockage over the Atlanta divide from Rome to Macon has a rise of 266 and a

fall of 705 feet, giving a total of 971 feet, which, with that of the Sandy Mountain division of 864, and of the Muscle Shoals in the Tennessee river, gives an aggregate of 1969 feet in all.

The estimate for the Georgia division, extending from Rome to Macon, was $20,500,000; that for the Alabama division, exclusive of Muscle Shoals, was a little less than $12,000,000; the total from Cairo to the Atlantic, about $40,000,000.

A brief history of the Muscle Shoals Canal has an important bearing on the time within which it may be expected the route can be opened if left exclusively to the National Government.

These shoals, extending over a stretch of 38.5 miles and having a fall of 134.2 feet, were early recognized as a serious obstacle "to the development of the population, wealth and resources of one of the richest agricultural and mineral regions of the United States. Accordingly, in 1828 the Board of Internal Improvements was directed by act of Congress to make an examination of the Muscle Shoals with a view to opening them to navigation. * * * Plans and estimates were submitted December 18, 1830, and approved by the President in March following. It was proposed to construct three basins by means of dams to be connected by locks and canals, and 400,000 acres of the public lands within the State of Alabama were appropriated for the purpose, accompanied by the condition that work should begin at the lower end, at Florence. The funds being insufficient, Congress authorized the middle basin to be built first, which was done against the advice of the board, filed March 25, 1831. As built the canal was 14.8 miles long, from 60 to 70 feet wide and 6 feet deep, with locks 120x32x6 feet, having a lift of four feet. The work was completed in July, 1836, and was extensively used when the river was high, but the shoals both above and below caused serious detentions, and the financial distress of 1837 rendered it impossible to secure more appropriations, either from the State or nation, to complete the remaining sections, so that it was gradually abandoned and was "soon overgrown with trees and shrubbery, which covered the 17 locks of excellent masonry," as well as the trunk of the canal, which had cost the country $700,000.

In 1868 interest in the subject was renewed, and an estimate submitted for an enlarged canal of 100x6 feet, with locks 300x70x6 feet, for $1,500,000. This was modified in 1872 by reviving the project of the board of 1832, with increased dimensions, at an estimated cost of $4,003,000, and again revised in 1877, by a third change in the officer in command of the district, to a plan of rip-rap and wing dams in place of the approved dams and canal, reducing the cost to about one-tenth by the proposed use of a locomotive and wire rope to haul the boats over the chutes.

In 1890 a board of engineers estimated that the canal would cost $4,133,000 between Decatur and Florence, 50 miles, and in 1892 an appropriation of $100,000 was made for this section. In 1892 it was determined to substitute one lock with a lift of 25 feet for two, and an allotment of $300,000 was made to begin the work.

In 1899, under a new administration, it was proposed to substitute a slackwater system for the lateral canal, but it was not approved by the board.

The canal was finally opened again to traffic on the Big Muscle Shoal section in 1890, 54 years later, and the attempt to improve Little Muscle Shoal by channel work was abandoned in favor of locks and dams.

The number of craft which passed through the canal in 1905 was 752, and the freight carried 17,796 tons, valued at $759,100.

Thus after some 70 years the Tennessee river had been opened to traffic, and it only remains for the localities most interested to complete the connection across the

Piedmont plateau to bring into the market this most productive and salubrious section of the federal domain.

Many instances might be cited as precedents where more difficult and far less promising canal undertakings have been built in sparsely-settled countries, with few mechanical appliances and little wealth, but these were overcome by the energy and determination of the people, who were building not only for themselves, but for posterity, and their works still survive as a monument to their devotion to a great cause. Are the people of this delightful Southland less energetic, appreciative of their opportunities or less resourceful?

To secure trade the facilities for cheap transportation must be provided, and the most expeditious way is by local initiative and resources. There are few such magnificent possibilities immediately available.